Disaggregating PTAs at the Role of International Division of Labor on PTA Formation

by Hazel Parcon,[*]
Department of Economics
University of Hawai‘i at Mānoa

Working Paper No. 08-06
October 2008

Abstract

This paper shows that additional insights on PTA formation can be gained from separating North-South, North-North, and South-South country pairs. Inter-industry trade is mostly significant for all country pairs and intra-industry trade has a positive impact only for North-South and North-North country pairs. Controlling for geographical proximity, countries choose PTA partners with which they have a history of trading. Using a simple model, this paper demonstrates that trade protection is not the necessary outcome with international product fragmentation. Empirical findings support the hypothesis that international division of labor has influenced the formation of North-South PTAs.

Key Words: preferential trading agreements, product fragmentation, trade policy
JEL Classification: F13, F15

[*] Department of Economics, University of Hawai‘i at Mānoa, 2424 Maile Way, Honolulu, HI 96822, USA. E-mail: hparcon@hawaii.edu

I. Introduction

The number of Preferential Trading Agreements (PTAs) has dramatically increased since 1980, when there were only 43 agreements in force. This number has multiplied almost nine times in less than three decades, growing to 380 as of 2007.[1] In a single PTA, two or more countries can be a party to it. If we consider all the possible pairs of countries that are currently in a PTA, then more than 600 country pairs are extending preferential trading arrangements to each other.[2] Chase (2005) mentioned that these trading arrangements raise three fundamental questions. First, why do countries form trading blocs? Second, what is the impact of trading blocs on the multilateral integration of the world economy? Third, how does the creation of trading blocs affect economic and political cooperation between regions? According to Chase, these questions are sequentially linked. Hence, in order to understand the second and third questions, analytic work must start on the first one. However, a majority of existing studies focus on the second and third questions. This motivates the current study to focus on the first question. In particular, this study asks "What factors help explain PTA formation among countries?" and "How do countries choose their PTA partners?" These questions essentially recognize that trade policy is endogenous – that is, PTA formation much like any other trade policy is motivated by *both* economic and political factors. However, existing studies on endogenous trade policy focus on political factors. In particular, these studies provide explanation of how trade policy is determined by a certain political process. This study departs from this literature by looking at the *economic* determinants of trade policy, in particular of PTA formation.

---

[1] This number only includes PTAs that were notified to the WTO. If PTAs in force, but not notified; signed, but not in force; currently being negotiated; and in the proposal stage are accounted for, then the total number of PTAs would reach 400 in 2010 (www.wto.org). According to the World Bank (Global Economic Prospects 2005), there are only 12 countries (US territories included) that are not recorded as being party to a PTA. In addition, on average each country is a member of five PTAs.

[2] See Appendix Table 1.

The literature on PTA formation mentions that PTAs are different from one another because countries have different objectives when they negotiate them. For instance, a South country may sign a PTA with a North country in an effort to be the latter's favored low-cost supplier. North countries, meanwhile, may forge a PTA with each other to gain economies of scale in the production of differentiated goods. Though previous theoretical studies have recognized the different motivations of countries, empirical studies have pooled different PTAs together. Hence, important relationships may have been concealed. Some factors influencing PTA formation may be common for all types of PTAs, but their relative importance may vary according to whether they are between North-North, South-South, and North-South countries. This research shows that there is a basis for disaggregating PTAs by country pairs using the models developed by Krugman (1991a, 1991b), Frankel, Stein, and Wei (1998), Deardorff and Stern (1994), Haveman (1996), and Spilimbergo and Stein (1998).

Next, I juxtapose the proliferation of PTAs with the recent trends in international division of labor. Most PTA models assume that countries trade only in final goods. However, it is but a reality that trade in intermediates is becoming more prominent in recent decades and this can be attributed to international product fragmentation, which has been growing at a rapid rate since the early 1980's (UNCTAD, 2006). Aggregate indicators of international product fragmentation have shown this to be the case.[3] Gross product associated with international production and foreign affiliate sales worldwide increased faster than global GDP and global exports. As seen in Appendix Table 2, both increased more than six-fold from 1982 to 2005. Gross product associated with international production was about $600 billion in 1982, but increased to $4 trillion by 2005. Sales of foreign affiliates worldwide stood at about $3 trillion in 1980, but has

[3] Three generally accepted proxy indicators for international product fragmentation are gross product associated with international production, global sales of foreign affiliates, and outward FDI stock (UNCTAD, 2006).

increased to about $22 trillion in 2005. According to UNCTAD (2000), half of the sales of foreign affiliates was intra-firm (either among affiliates or between parents and their affiliates), which is a manifestation of international product fragmentation. Outward FDI stock, albeit an imperfect measure of international production, has likewise increased. Standing at $600 billion in 1982, it jumped to $10 trillion in 2005. Existing studies have pointed out that firms involved with international production strategies prefer a free trading environment and harmonized international regulations.[4] Thus, countries that are substantially involved in international production may have more motivation to seek trading arrangements. Given these, this study will investigate the possible role of international product fragmentation on PTA formation, which has not been considered yet in past studies. I believe that recent developments in the patterns of international division of labor are a driving force in the evolution of international trade regimes. The relationship between PTAs and firm activity is typically analyzed with the causality running from the former to the latter.[5] This study recognizes the possibility that causality runs in the opposite direction.

Therefore, I raise two main questions in this study. First, what factors motivate North and South countries to choose countries of the same or different type for a PTA? Second, does international product fragmentation influence North-South PTA formation? Answers to these questions are important for policy makers. Results of the study may provide an explanation why PTAs proliferate in spite of the World Trade Organization (WTO) and may give insights as to how the rules of the WTO should adapt to reflect developments in the patterns of international division of labor.

[4] See for instance Lipson (1982), Cantwell (1994), Cheng, Liu, and Yang (2000), Arndt and Kierzkowski (2001), Cheng and Kierzkowski (2001), Ando (2005), and Blanchard (2005).
[5] For instance, Medvedev (2006), Baldwin (2001), and Anderson and Blackhurst (1993).

Before proceeding, it is worth mentioning the limitations of this study. This research does not seek to give a full account of PTA determinants. Instead, it provides explanations on the formation of PTAs and the choice of PTA partners that are grounded on economic theory. Political factors will be accounted for, but it will not be the focus of the discussion.

In addition, before proceeding some terms need to be clarified. First, a Preferential Trading Agreement or PTA is defined as a union between two or more countries in which goods produced within the union are subject to lower trade barriers than the goods produced outside the union. Second, the term PTA will be used to refer to free trade areas, custom unions, and common markets, which all fall within the purview of GATT Article XXIV.[6] This study does not make any distinction among these arrangements. Third, the term PTA will be interchangeably used with trading blocs throughout the discussion.

This study is organized as follows: Section II gives a review of the literature on theoretical studies of trading bloc formation, which provides empirical basis for separating PTAs into North-South, North-North, and South-South PTAs. Likewise, studies that link international product fragmentation and trade policy are presented. Section III presents the hypotheses based on the studies presented in Section II. In addition, a simple model is presented to show how international product fragmentation can possibly influence PTA formation. Section IV presents the empirical methodology. Section V presents the empirical results and analysis. Section VI concludes.

[6] Bhagwati and Panagariya (1996)

II. Related Literature

The pioneering work on custom unions of Viner (1950), where analysis of trade creation and trade diversion was introduced, is the basis of most theoretical studies on trading bloc formation. Trade creation occurs when imports increase from a member country to replace domestic production that prior to the agreement, was being produced domestically at a relatively high cost. Trade diversion, meanwhile, arises when imports from a low cost non-member country is reduced in favor of a relatively high cost member country.[7] The possibility of trade diversion is the principal objection to the formation of PTAs. Thus, most studies argue that countries should choose PTA partners such that trade diversion is minimized.[8]

One important contributor on the theory of trading bloc formation is Krugman (1991a, 1991b). Using a monopolistic competition framework with one factor of production[9], Krugman (1991a) presented a trading bloc model in a world with symmetric nations and complete product-differentiation. With labor as the only factor of production, comparative advantage gains from trade are ruled out. This means that product variety and internal economies of scale in the production of each variety are the sources of gains from trade. Since each variety of the good will be produced in only one country, then there is no reason for countries to compete for markets and so countries' products will be imperfect substitutes. Since preferences are likewise symmetric, countries will tend to consume all countries' goods equally. With zero intra- and inter-continental transportation costs, forming few trading blocs would have a tendency to reduce world welfare since countries substitute goods away from each other. This trade diversion

[7] Bhagwati and Panagariya (1996)
[8] Kemp and Wan (1976) argued that trading blocs are always potentially beneficial to its members. In particular, if members reduce their external tariffs to the point that external trade remains at its pre-trading bloc level, then members can ensure that there would be no trade diversion
[9] Krugman (1991a, 1991b) used the monopolistic competition framework in Krugman (1979).

reduces the volume of trade between two countries that are in different blocs, which is reinforced by a rise in the tariff rate between countries in different blocs.[10]

However, Krugman (1991b) explains that when trading blocs are formed by countries that are natural trading partners, then the possibility of trade diversion is minimized. Countries being natural trading partners may come in two forms. In the first form, the emphasis is on transportation costs that are assumed low between countries within the same region or continent. In the second form, the emphasis is on large initial volume of trade that may result, *inter alia*, from geographical proximity.[11] In either case, countries are referred to as natural trading partners. Based on the first form, Krugman (1991b) argued that when prohibitively high inter-continental transportation costs[12] exist and intra-continental transportation costs are zero, then a trading bloc within a continent is welfare-improving even among similar countries where trade is based on product variety. This result holds even for non-prohibitive but sufficiently high inter-continental transportation costs as shown by Frankel, Stein, and Wei (1998). The latter emphasized that trading costs includes not just transportation costs, but considerations on familiarity with laws and institutions; and adaptability to market conditions as well.

Deardorff and Stern (1994) presented a trading bloc model where countries may differ in either technologies or factor endowments; hence comparative advantage gains from trade are captured. Unlike Krugman (1991b) and Frankel, Stein, and Wei (1998), the model is silent about geographical proximity. Rather, the model emphasizes that forming a trading bloc with at least one country of dissimilar technology is enough to realize more than half of the gains from free

---

[10] Three trading blocs will give the lowest world welfare. However, as the number of blocs increases beyond three, world welfare will increase. The reason for this is that in a world with many small blocs, no bloc would have significant market power, and since most of each bloc's consumption would be imported and subject to the same external tariff, there would be little trade diversion (Krugman, 1991b).

[11] Bhagwati and Panagariya (1996)

[12] These take Samuelson's iceberg form; that is, of a unit of a good shipped from one continent to another, only a fraction $1-\gamma$ arrives.

trade. This result holds in a multiple-country setting as long as the autarky price of a country is different from the trading bloc equilibrium price. Similarly, Haveman (1996) shows that if the least similar countries form trading blocs, world welfare can increase. However, Haveman defined similarity of countries in terms of their geographical proximity. He argued that relative endowments of primary factors and stage of development are highly correlated with geographical proximity. Therefore, this implies that the farther two countries are geographically, the greater is the welfare increase. This line of reasoning is problematic since it assumes that transportation costs do not exist. If transportation costs are substantial, then it is possible for the comparative advantage gains from trade to dissipate.

A limitation of aforementioned models is that analysis is based only on the exchange of final goods. However, stylized facts show that trade in intermediate goods has grown in importance in the past two decades. The trading bloc model of Spilimbergo and Stein (1998) reflect this phenomenon. Spilimbergo and Stein (henceforth SS) consider trade in intermediate goods and trading bloc formation among countries at different levels of development (North-South) as well as those formed among similar countries (South-South and North-North). Countries that are more capital-abundant are classified as North, while those that are more labor-abundant are classified as South. Labor is assumed to be specific in the production of the agricultural good, while capital is specific in intermediates that are used to produce manufactures.

SS assigned different values to their model parameters and used simulation technique to determine which type of bloc will give the highest welfare to different types of countries. For the case where transportation costs are zero, they showed that if tariffs are positive and equal across countries and when the main motivation for trade is to take advantage of product variety rather than cost differentials, then both North and South countries should form trading blocs with

North countries as this will give them the highest welfare. In addition, since North countries are capital-abundant, then it follows that they will produce the different varieties of intermediate goods. If the main motivation for trade were to take advantage of cost differentials, then any country would want to form a trading bloc with a country of the opposite type. They showed that only for the case when inter-continental transportation costs are sufficiently high would a South country prefer forming a trading bloc with a geographically proximate South country.

A limitation of the SS model is that it is a specific-factors model. Thus, one cannot really be certain whether the trade patterns are really due to comparative advantage. Moreover, since intermediates are produced using capital only, then the capital-abundant North countries would necessarily produce all intermediate goods. This leaves no room for South countries to produce intermediate goods. Thus, if cost differential is the main motivation to form a PTA, then North and South countries would only do so because of their trade in final goods, which is actually not well represented in reality. Furthermore, as pointed out by Haveman (1998), the motivation of South countries to form trading blocs with North countries on the basis of product variety is highly questionable. Haveman points out that in most cases South countries are more concerned with securing the source of supply for their daily needs than varying the composition of their expenditures.

The works of Ethier (1982), and Jones and Kierzkowski (1990), although not trading bloc models, provide for the possibility that North and South countries trade not only in final goods, but in intermediate goods as well. In addition, they give room for South countries to participate in intermediate goods trade, in contrast to SS. This is made possible by international product fragmentation. This is related to the work of Chase (2005), which contends that the principal attraction of PTAs is the opportunity they create for businesses to reorganize operations and maximize profits. Together with Bhagwati and Panagariya (1996), he criticized the fact that too

much emphasis is given to trade creation and diversion as the main criterion for PTA formation.[13] He argued that a country will seek a trading bloc in order for producers to move stages of production across borders. If different stages of production can be located in different locations where each can be performed most efficiently, then producer profit is maximized. Since barriers to trade and investment restrict opportunities of a country to take advantage of differences in wages, skills, and capital costs among countries, forming a trading bloc will enable countries to take advantage of such opportunities. Hence, if there is potential for producers to engage in international product fragmentation that makes production more efficient, the greater is the probability that a trading bloc will be formed.

Using NAFTA as an example, Chase showed that U.S. multinationals sought free trade with Mexico and Canada to allow them to reorganize factories, outsource labor-intensive tasks, and rescale production. This implies that the trade policy of a country is essentially endogenous. However, this is in contrast to the mainstream literature of endogenous trade policy were firms are mostly characterized as seeking trade protection.[14] The reason for this is that the firms represented in these studies are import-competing firms. According to Bagwell and Staiger (2003), these studies ignore other production sectors that might press for less protection. They contend that a reciprocal trade agreement that lowers import tariffs may be highly valued by exporting firms and domestic firms that substantially use imported inputs. This is related to the works of Lipson (1982), Milner (1993), Cantwell (1994), Cheng, Liu, and Yang (1998), and Blanchard (2005), which argued that trade policies of a country are related to the international economic activities of its firms. In particular, when countries have more firms involved in

[13] Similar criticism was put forth by Harilal and Beena (2003) that the traditional analysis of PTAs based on trade creation and trade diversion suffer from failure to take into account the interaction between final and intermediate goods.

[14] See for instance Mayer (1984), Magee, Brock, and Young (1989), Dornbusch and Frankel (1987), Bohara and Kaempfer (1991), Grossman and Helpman (1994), Henriques and Sadorsky (1994), Krol (1995).

international product fragmentation and global intra-firm trade, there is more pressure for trade liberalization since trade barriers are additional trade costs. In addition, when countries participate in international division of labor, they receive more gains from trade; the most important ones may be non-pecuniary such as productivity gains and expansion of network. Therefore, setting high tariffs may dissipate these possible gains from trade.

Empirical studies on PTA formation have so far failed to recognize the two points that I am raising here. Most empirical studies on the determinants of PTAs focus on the factors driving their formation irrespective of the PTA type[15]. Though theoretical studies obviously suggest that different types of countries have different motivations when they seek a particular country type as a partner, empirical studies have pooled different PTA types together. In addition, most empirical studies predict whether PTAs will be formed between a developed and developing country, two developing, or two developed countries based on the factors that influence PTA formation. However, there is no consensus among these studies. For instance, Ethier (1998), Krueger (1999), and Baier and Bergstrand (2004) predict that PTAs will be more likely between developed and developing countries; while Magee (2003) predicts that PTAs will be more likely between two developed or two developing countries. What is lacking in the empirical literature is an explanation of what drives countries at different levels of development to choose certain countries as their partner. For instance, it would be interesting to ask, "Given a choice of North countries, what makes a North choose another North?" Similarly, "Given a choice of South countries, what makes a North country choose a specific South country?" Or "Can international product fragmentation influence North-South PTA formation?" Asking these types of questions maybe a more worthwhile exercise than trying to predict which types of

[15] By PTA type I mean North-South, North-North, and South-South PTAs.

countries will form a PTA, since all PTAs are formed by almost all countries at different levels of development anyway.

III. Theoretical Framework

A. A Case for Disaggregating PTAs by Country-Pair Type

Table 1. Models of PTA Formation

Models	Types of Countries (Based on Factor Endowments)	Motivation for Trade	Type of Trade	Goods Traded	Distance/Geographical Proximity
Krugman (1991b)	Similar	Product Variety Gains / Economies of Scale	Intra-industry	Final	Countries must be geographically proximate
Frankel, Stein, and Wei (1998)					
Spilimbergo and Stein (1998)				Intermediate	
Deardorff and Stern (1994)	Dissimilar Countries	Cost Differentials	Inter-industry	Final	Zero Transportation Cost
Haveman (1996)					Countries must be geographically distant
Spilimbergo and Stein (1998)					Countries must be geographically proximate
Ethier (1982)	Dissimilar Countries	Cost Differentials	Intra-industry	Intermediate	Zero Transportation Cost
Jones and Kierzkowski (1990)					Countries must be geographically proximate

Table 1 provides a summary of the theoretical models that may help explain PTA formation. Based on the natural trading partners hypothesis, countries that already have a significant trading relationship and are geographically proximate have more tendency to form PTAs, since trade diversion is minimized. However, based on above models, the impact of trading relationship and geographical proximity may depend on the types of countries. It is obvious that factors that influence countries to form PTAs vary with different country types. If countries are classified into two types based on their relative factor endowments, where North

countries are relatively capital-abundant and South countries are relatively labor-abundant, there will be three possible types of PTAs.

1. North-North PTAs

North countries may want to form PTAs with each other to take advantage of product variety gains and economies of scale in trading differentiated final and intermediate goods, which means that trade is mostly intra-industry. Therefore, as suggested by the natural trading partners hypothesis, North countries will have a greater tendency to form PTAs with each other if they have significant intra-industry trade. In addition, theories suggest that they should be geographically proximate or located in the same region to minimize trade costs.

2. South-South PTAs

Similar to North-North PTAs, due to similarity of factor endowments, one may argue that South countries may want to form PTAs with each other to take advantage of product variety gains and economies of scale, so that trade is mostly intra-industry. However, the literature on intra-industry trade suggest that intra-industry trade among similar countries is a phenomenon more common for high-income countries since it requires a certain degree of income level and a market large enough to accommodate each differentiated good.[16] In addition, intra-industry trade is a phenomenon more common for manufactured goods, which are mostly produced in high-income countries.[17] It is possible though that South countries trade in intermediate goods that are labor-intensive. Labor-intensive intermediate goods may be traded by one South country to another for further processing into yet another labor-intensive intermediate good. Based on theories presented, since a South-South country pair seems to have lesser basis for and gains from trading with each other compared to North-North country pairs [18], then geographical

[16] Helpman and Krugman (1985)
[17] Helpman and Krugman (1989)
[18] As well as North-South country pairs, as will be discussed next

proximity should be a primary concern so that the possible trade gains will not be outweighed by costs associated with distance.

3. North-South PTAs

The main motivation for dissimilar countries, meanwhile, is to take advantage of cost differentials. Theories suggest that dissimilar countries may trade in both final and intermediate goods, where the former is inter-industry and the latter is intra-industry. Therefore, as suggested by the natural trading partners hypothesis, dissimilar countries will have a greater tendency to form PTAs with each other if they have significant inter-industry trade in final goods and intra-industry trade in intermediate goods. With regard to geographical proximity, there is no consensus among theories whether distance should be a primary concern or not for dissimilar countries forming a PTA. However, it is reasonable to argue that countries should not be too distant with each other such that the gains from cheaper access to goods are outweighed by costs associated with distance.

The aforementioned leads to the following:

Hypothesis 1: The relevance of trading relationship and geographical proximity as factors influencing PTA formation varies across different country pairs.

(i) Trading Relationship

Inter-industry trade as a driving force of PTA formation is expected to be most significant for North-South country pairs since only this type of country pair has the motive for trading across different industries. However, in reality since countries of the same type are not perfectly identical, then inter-industry trade may be significant as well for both North-North and South-South country pairs, though the effect may not be as large as that for North-South country pairs.

The impact of intra-industry trade on PTA formation is expected to be largest for North-North country pairs, since this type of country-pair mostly engage in such type of trade. Intra-

industry trade is expected to be significant as well for North-South country pairs, as they engage in intra-industry trade in intermediate goods, though the effect may not be as large as that for North-North country pairs. Intra-industry trade is expected to be an insignificant factor for South-South country pairs.

(ii) Geographical Proximity/Distance

Since South-South country pairs have least basis for and gains from trading with each other compared to North-North and North-South country pairs, then geographical proximity should be a primary concern for South-South country pairs, so that any possible trade gains will not be outweighed by costs associated with distance. Therefore, the role of distance is expected to be largest for South-South country pairs compared to the other two country pairs. Geographical proximity is expected to be significant as well for North-South and North-North country pairs, so that the gains from access to cheaper goods, and product variety gains from trade and economies of scale, respectively, will not be outweighed by costs associated with distance.

B. A Case for the Possible Role of IPF on PTA Formation

Now, consider possible relationships that are not obvious when different country types are pooled together. One of these is the possible role of IPF (international product fragmentation) in the formation of North-South PTAs. This section first presents countries' motivation to undergo product fragmentation at the international scale. Then, different cases are presented on how IPF can possibly influence PTA formation.

B.1 Motivation for IPF

Jones and Kierzkowski (1990), Ethier (1982), and numerous other studies[19] have shown that trade in intermediate goods between dissimilar countries can be largely explained by IPF. In a Ricardian setting with a manufactured good and two countries – home and foreign, which are similar in all aspects except for technology, countries are shown to have an incentive to fragment the production of the manufactured good across international borders. Suppose home has the comparative advantage in producing the entire manufactured good. Furthermore, the production of the good is separable into two production blocs, where each bloc requires a different technology. It is possible that although foreign has comparative disadvantage in producing the entire manufactured good, that it has comparative advantage in producing the good's components in one of the two production blocs.

The same analysis can be applied under a Heckscher-Ohlin framework, where the two production blocs can be assumed to have different factor intensities and home and foreign countries have different factor endowments. Suppose that the first production bloc is relatively more capital-intensive and the second is relatively more labor-intensive. If home is relatively more capital-abundant and foreign is relatively more labor-abundant, this implies that home will have an incentive to pass the second production bloc to foreign. This result can be extended to a multi-country and multi-production bloc setting, where the more capital-intensive production blocs are produced in the relatively more capital-abundant countries. This is similar to Helpman's (1981) model of differentiated final and middle products - a country with higher capital-labor ratio produces varieties from at least one commodity group[20] such that the capital

[19] See for instance Jones (2000), and Cheng and Kierzkowski (2001), Jones and Kierzkowski (2001), Kimura (2001) and Ando (2005).
[20] A commodity group consist of the different varieties of the same good.

intensity of this group is higher than the capital intensity of all groups being produced in capital poor countries.

The implication of the works of both Jones and Kierzkowski, and Ethier is that since IPF enables production of different components of a final good at the lowest cost, then marginal costs of final good producers fall. Hence, the price of the manufactured good falls. A dissimilarity between Jones and Kierzkowski, and Ethier is that the latter assumes that the components produced in different countries can be costlessly assembled into a final good; that is, no international service link costs[21] exist, whereas the former placed great emphasis on service link costs as an important factor in determining the existence of IPF. If service link costs are high, it is possible for IPF not to be undertaken. What is missing in both studies, however, is the presence of trade barriers across countries.

The foregoing suggests that the overall cost advantage derived from IPF depends on (1) cost advantage due to differences in technology or relative factor endowments and (2) cost of fragmentation, which includes service link costs and trade barriers. For the cost of fragmentation, I focus on the factors implied by the natural trading partners hypothesis, namely, transportation costs and trade barriers.

Let t be tariffs and a be transportation cost that takes the form of Samuelson's iceberg cost. This means that of a unit of a good shipped from one country to another, only a fraction $1-a$ arrives. Given these, let $\tau = \left(\frac{1+t}{1-a}\right)$, which I refer to as the *cost of IPF*. Therefore, given a, τ increases as t increases; and given t, τ increases as a increases. Next, let ρ be the *cost advantage afforded by IPF due to difference in technology or relative factor endowments*. If

[21] Jones and Kierzkowski defined service link costs as the costs associated with coordination, administration, transportation, communication, and financial services that must be necessarily incurred when production process is fragmented.

$\rho > 1$, this implies that foreign has a comparative advantage in the production of a given fragment of a good relative to home, where the comparative advantage is due to difference in technology or relative factor endowments. Thus, the *overall cost advantage from IPF* is given by $\gamma = \frac{\rho}{\tau}$. This implies that home will only have an incentive to fragment production at the international scale when the gains from decreased production costs outweigh the costs of international transportation costs and trade barriers; that is when $\gamma > 1$.

B.2 Motivation for PTA Formation due to IPF

In this section, a simple model is presented that is tailored to address the prevalence of IPF and how it can possibly affect PTA formation. It is assumed that governments are apolitical and a pair of countries' social planners are making a decision of maximizing their respective country's domestic welfare. Each country will only have an incentive to form a PTA with the other if the change in welfare from moving from a non-discriminatory environment of most favored nation (MFN) to a PTA is positive, that is

(1) $\Delta W = W^{PTA} - W^{MFN} > 0.$

Therefore, a PTA will be formed between home (h) and foreign (f) only if min $(\Delta W_h, \Delta W_f) > 0$.

Assume that home is relatively capital-abundant and foreign is labor-abundant. On this basis, home is a North and foreign is a South country. In addition, the economy has two factors of production: capital (K) and labor (L); and three sectors: agriculture (A), intermediate inputs or components (V), and manufactures (M). All goods are produced using both K and L. A is produced under constant returns to scale and M and V under increasing returns to scale. A is produced under a perfectly competitive market, M under a monopolistically competitive market, and V under an oligopolistic market. Production of A is assumed to be labor-intensive, while M is capital-intensive. The production of M is separable. There are two components used to

produce M. Component V_1 is more labor-intensive and V_2 more capital-intensive. The assembly of the components to produce the final good is assumed to require a technology that is capital-intensive. Thus, it can be treated as part of V_2. Given these, the production function of M is given by

(2) $M = f[K, L, V(V_1, V_2)]$.

Let w_K, w_L, and w_{Vj} be the costs of capital, labor, and component j where j=1, 2. The total cost associated with producing M is therefore given by

(3) $C = f[w_K, w_L, w_{Vj}(w_K, w_L)]$.

Case 1. No IPF

Assume that there is one North and one South country and that the current technology does not allow for IPF. I follow Deardorff (2001) and assume that the two countries have sufficiently different factor endowments so that countries are outside the cone of diversification.[22] This implies that Home produces all the intermediate inputs needed to produce M and that the two countries will trade only in final goods, where North exports M and South exports A.

Case 2. IPF, Prohibitive Trade Costs, and Zero Transportation Costs

Assume that technological development makes IPF possible.[23] For simplicity, assume that components V_1 and V_2 can be produced in two separate production blocs. Let the production blocs that produce the labor- and capital-intensive components be referred to as PBL and PBK, respectively. Since South is labor-intensive, then it should have cost advantage in

[22] Deardorff (2001) presents a model of fragmentation across cones, where countries fall outside the cone diversification. Due to this, factor price equalization is not achieved even with free trade. This provides more bases for product fragmentation across countries so that countries will be able to take advantage of factor price differences.

[23] Jones (2000) mentions that this technological development may be due to advances in information and communications technology. For instance, advances in the computer industry have allowed virtually costless means of communication anywhere in the world through the Internet.

producing the labor-intensive component than North. Let South's cost advantage relative to North in producing the labor-intensive component be equal to ρ_S. This implies that the necessary condition for North to consider IPF is $\rho_S > 1$. If $\rho_S \leq 1$, IPF will not be even considered. However, this is not a sufficient condition for IPF. When product fragmentation is done at the international level, the price of inputs faced by producers of M in North includes not only the production costs, but transportation and trade costs as well, that is, $\tau \neq 1$. This implies that the sufficient condition for IPF to be considered by North is given by

$$(4) \qquad \frac{\rho_S}{\left(\frac{1+t}{1-a}\right)} > 1.$$

For the inequality in (4) to hold, it must be that $\rho_S > \left(\frac{1+t}{1-a}\right)$. In order to focus on trade costs, let $a = 0$. This leads to

$$(5) \qquad \rho_S > (1 + t).$$

This implies that there is a maximum level of t that would make IPF a worthwhile activity, which I refer to as t_{IPF}. If the existing tariff rate is too high, that is, $t > t_{IPF}$, then IPF will not be undertaken. This implies that IPF may put pressure on countries to lower their trade barriers. North may lower its trade barriers to intermediate goods coming from South in order to undertake IPF. In fact, given zero transportation costs, (5) will definitely hold when t is set equal to zero. Similarly, Deardorff (2001) emphasized the role of trade barriers in discouraging IPF. He showed that trade barriers in intermediate goods may render IPF unprofitable, even when it would otherwise lower production costs.

Case 3. IPF, Non-Prohibitive Trade Costs, Positive Transportation Costs

Assume that there are two South countries, S1 and S2, which are identical. In each South country, there are oligopolistic firms that host PBL. Since S1 and S2 are identical, this implies

that they have the same cost advantage over the North country, which I call N1, in hosting PBL; that is, $\rho_{S1} = \rho_{S2} > 1$. Assume that the solution concept of firms hosting PBL is Bertrand competition. In equilibrium, as long as both South countries face the same transportation costs and trade barriers with respect to N1, the outcome will be the perfectly competitive outcome, where firms in both countries will equally share in the market of N1 and price will be equal to marginal costs, where the marginal costs include t and a, aside from production costs.[24]

Under a MFN environment, all firms in both South countries face the same tariffs, t_{MFN}. However, if the two South countries do not have the same distance from N1, then the cost of V_1 coming from the two South countries will differ due to difference in transportation costs. For instance, S1 is nearer to N1 than S2. This means that

(6) $a_{s1} < a_{s2}$, which in turn implies that

(7) $$\frac{\rho_{s1}}{\left(\frac{1+t_{MFN}}{1-a_{s1}}\right)} > \frac{\rho_{s2}}{\left(\frac{1+t_{MFN}}{1-a_{s2}}\right)}$$, and

(8) $w_{1s1} < w_{1s2}$.

In this case, N1 will choose S1 as its low-cost provider of V_1 and firms in S2 are driven out of N1's market. This will hold in equilibrium if there is no other way for S2 to undercut the price of S1.

Suppose that S2 decides to use GATT Article XXIV[25] to undercut S1 to gain N1's entire market, by forging a preferential trading agreement with N1 that results in a tariff level equal to

[24] See Mas-Colell, Whinston , and Green (1995), page 388-389. Under Bertrand competition, when oligopolistic firms' price is set above marginal cost, each firm will always have an incentive to undercut each other's price. In equilibrium, all firms charge a price equal to the marginal cost.

[25] GATT Article XXIV allows for countries to form preferential trading agreements, provided that duties and other regulations imposed on countries not part of the agreement are not more restrictive prior to the formation of the agreement.

t_{PTA} that is lower than t_{MFN}. Therefore, although $a_{s1} < a_{s2}$, if $t_{MFN} > t_{PTA}$, then it is possible to have

$$(9) \qquad \frac{\rho_{s1}}{\left(\frac{1+t_{MFN}}{1-a_{s1}}\right)} < \frac{\rho_{s2}}{\left(\frac{1+t_{PTA}}{1-a_{s2}}\right)}.$$

Since $\rho_{S1} = \rho_{S2}$ by assumption, the inequality will hold if

$$(10) \qquad \left(\frac{1+t_{MFN}}{1+t_{PTA}}\right) > \left(\frac{1-a_{s1}}{1-a_{s2}}\right).$$

Let A = $\left(\frac{1-a_{s1}}{1-a_{s2}}\right)$ be the ratio of transportation costs. Since $a_{s1} < a_{s2}$, then A>1.

Let D = $\left(\frac{1+t_{MFN}}{1+t_{PTA}}\right)$ be the ratio of trade costs faced by North when components are bought from S1 and S2. Since $t_{MFN} > t_{PTA}$, then D>1. Therefore, in order for S2 to possibly undercut S1, it must be that

(11) D > A > 1

One way to satisfy this is to set a very low or zero t_{PTA}. However, even if t_{PTA} drops to zero, (11) is not necessarily satisfied. This may happen if S2 is sufficiently far and S1 is very near N1. In this case, it is possible to have D < A. This implies that S2 cannot just form a PTA with N1 to undercut S1 as the low-cost provider of N1. Only when (11) is satisfied could S2 undercut S1. Nevertheless, just the threat of S2 undercutting S1 will give the latter an incentive to negotiate with N1 to form a PTA. Once N1 chooses S1 as its source of V_1, it is rational for S1 to initiate a negotiation with N1 to form a PTA to secure its position as the low-cost provider of N1.

Through this, S1 ensures that $\gamma_{s1} > \gamma_{s2}$. Therefore, in equilibrium, N1 and S1 form a PTA and S2 is driven out of N1's market.[26]

What the foregoing shows is that trade policy may be influenced by IPF. In Case 2, even when transportation costs are zero, if trade costs are high then IPF will not be undertaken. This may put pressure on the country that wants to take advantage of IPF to lower its trade costs. In Case 3, even if IPF is already being undertaken, IPF can influence trade policy when a country wants to secure its trading relationship with another country.

The aforementioned suggests that IPF can possibly influence trade policy by encouraging North and South countries to form a PTA, which leads to the following:

Hypothesis 2: IPF has a positive impact on the probability that a North-South country pair would form a PTA.

C. Net Impact on Domestic Welfare of IPF Under MFN or PTA

Using Case 3, I consider the impact on domestic welfare of IPF under MFN and PTA by using the following representation of change in a country's domestic welfare[27]:

(12) $dW = p^* \cdot dQ - e \cdot dp^*,$

where p* denotes foreign prices, Q denotes domestic production, $e > 0$ denotes an imported good, and $e < 0$ denotes an exported good. The first term on the right hand side represents the effect of volume of trade changes to domestic welfare, while the second term represents effect of terms of trade changes to domestic welfare.

---

[26] If the strategic variable chosen was quantity instead of price, then Cournot equilibrium is the outcome, where both S1 and S2 can share in N1's market. As long as the quantity chosen by the both countries does not result in a price of components that is greater than the price of those components at N1, then this is a possible outcome. However, if the quantity chosen by both countries increases price substantially, then IPF may become unprofitable for N1 and so both S1 and S2 will be driven out of N1's market. Though Cournot competition may be used to model the behavior of S1 and S2, Bertrand price competition seems to be the more appropriate model to link IPF and PTA formation. The reason for this is that N1 uses IPF to take advantage of cost differentials; hence, price is the more logical choice of strategic variable rather than quantity.

[27] See Helpman and Krugman (1989), page 23-24, for derivation.

When tariffs are lowered from a MFN environment to a PTA between North and South, the volume of trade between the two countries increases, exclusive of any increase caused by IPF. The increase in volume of trade does not only include trade in final goods, but trade in intermediate goods as well. Thus, the first term is unambiguously positive for both countries. The impact on terms of trade for the North and South countries are different. For the South country, the decline in P_M decreases the price of its importable good. The reduction of tariffs due to a movement from a MFN environment to PTA increases the price of South's export goods – V_1 and A. Therefore, South's terms of trade unambiguously improves. Hence, together with the impact on South's volume of trade, the movement from a MFN environment to PTA is certainly welfare improving for the South country.

The impact on North's terms of trade is ambiguous. Since the price of its export good, P_M, falls as a result of IPF, a negative impact is exerted on its terms of trade. However, the movement from a MFN environment to PTA reduces the price it faces for its imported intermediate goods, which exerts a positive impact on its terms of trade. Hence, the net impact on North's terms of trade is uncertain. The net impact on its domestic welfare is likewise ambiguous. However, what is apparent is that the terms of trade motive for the North country to raise tariffs is reduced or may even be eliminated since it does not only trade in final products but also in components used in the latter's production. Since production of V_1 ceases in the North due to IPF, then there will be less incentive for North to raise tariffs as it becomes fully dependent on South for supply of such components. Lowering tariff to the supplier of intermediate goods seems to be a reasonable policy for North. This is reinforced when there are few South countries that can possibly supply V_1. Raising tariffs may come at a great cost to producers of M in the North country. Given these, if MFN tariffs are too high, IPF can therefore motivate a North country to form a PTA with its low-cost provider South.

Though not represented in (12), Deardorff (2001) and Arndt (1998) point out that the lower price of imported inputs faced by producers of M in North lowers the price of the final manufactured good. Hence, if M is a large proportion of consumers' budget, then real incomes could rise in both countries, which further increase domestic welfare.[28]

The foregoing has focused on the possibility that trade policy is formed from the point of view of exporters that are highly dependent on imported inputs. This is in contrast to the traditional literature that has focused on the formation of trade policy from the point of view of import-competing domestic firms, where trade policy is motivated to protect them and extract rents from foreign competitors. In the simple model presented, both countries have an incentive to negotiate for a preferential trading agreement to lower tariffs. The importing North country has an incentive to enter into a PTA to lower the cost of intermediate inputs used by its exporters. The South country, meanwhile, apart from the positive impact on its volume of trade and terms of trade of lower tariffs, has an incentive to enter into a PTA in order to secure its trading relationship with the North country. Thus, I have shown that it is possible to satisfy equation (1) for both countries, which in turn implies that $\min(\Delta W_h, \Delta W_f) > 0$ and therefore, a PTA will be formed between the two countries.

[28] This representation of the domestic welfare function is chosen for model simplicity and tractability. Though the possible loss in tariff revenue due to PTA formation is not accounted for, I do not downplay its possible importance. Several studies have shown that reduction in tax revenues need not necessarily result in lower domestic welfare. For instance, Baunsgaard and Keen (2005) contend that tariff reduction may be socially beneficial even when it is accompanied by reduction in total revenue because the increased openness of a country can lead not only to increased trade volumes, but to allocative efficiency of resources. Thus, trade liberalization may to some degree pay for itself. Walkenhorst (2006), meanwhile, argue that if tariff reductions (to levels above zero) generate a more-than-proportional increase in trade flows, then government revenues from trade taxes need not fall. In addition, revenues from sales and income taxes are likely to grow because of higher domestic consumption arising from lower prices of tradables, and higher growth resulting from the improved allocation of resources in the economy. Others such as Keen and Ligthart (2001) and Clarete and Whalley (1987) suggest that countries should complement tariff reductions with domestic tax reforms (strengthening domestic indirect taxes, broadening the tax base, and increasing the administrative efficiency of domestic tax collection) to fully reap the benefits of the former.

IV. Empirical Methodology and Data

In order to test my hypotheses, following Baier and Bergstrand (2004), I use the qualitative choice model of McFadden (1975)[29]. Qualitative choice models provide a framework to estimate the probability that a pair of countries' governments or social planners is making a decision as if maximizing their respective agents' utilities in the absence of actual observations of utility.[30] Related to this, I assume that when social planners make a decision to form a PTA, they ignore the impact of their decision on nonmember countries.

Let Z be a latent variable that represents the difference in utility levels from the formation of a PTA. Assume that a PTA will be formed by the governments of home and foreign only when the change in domestic welfare from doing so for both countries is positive. The difference in welfare levels and hence of the probability that a PTA will be formed depends on a vector of variables, X. These can be represented by the following:

(13) $Z = \min(\Delta W_h, \Delta W_f)$

(14) $Z = \alpha + X\beta + \varepsilon$

where β is a vector of parameters and ε is an error term assumed to be independent of X. Since Z is unobservable, an indicator variable, PTA* is set to be equal 1 when $Z > 0$; that is, when a PTA is formed; and equal to 0 when $Z \leq 0$; that is, when a PTA is not formed. Therefore, the response probability, P, for PTA* is:

(15) $P(PTA^* = 1) = P(Z > 0) = G(\alpha + X\beta)$

where G( ) is the cumulative distribution function.

To test *Hypothesis 1*and *2*, the following variables are included in X:

[29] Wooldridge (2002)
[30] Baier and Bergstrand (2004)

Distance between country pairs is used to account for geographical proximity. Based on the natural trading partners hypothesis, distance is expected to be negatively related to the probability of a PTA being formed for any country pair, but the weight of its importance may differ per country pair, as pointed out in *Hypothesis 1(ii).*

Total bilateral merchandise trade is used to measure the volume of trade between countries. It is expected to be positively related to the probability of PTA formation for all country pairs, as suggested by the natural trading partners hypothesis. To test *Hypothesis 1(i)*, total bilateral trade is decomposed into inter-industry and intra-industry trades.[31] Total net trade for each country pair is used to account for inter-industry trade. Based on *Hypothesis 1(i),* this variable is expected to be most significant for North-South country pairs. The Grubel-Lloyd intra-industry trade index (IIT) for each country pair is used to account for intra-industry trade. It is used as a proxy variable for trade in differentiated final goods for North-North country pairs and trade in intermediate goods for North-South country pairs. Based on *Hypothesis 1(i),* it is expected to be positive and significant for North-North and North-South country pairs, but not for South-South country pairs.[32]

IIT for North-South country pairs is likewise used as a proxy for IPF. Based on existing literature, countries with dissimilar factor endowments that engage in international product fragmentation have substantial intra-industry trade.[33] If IIT is positively related to the

[31] A detailed explanation of how inter- and intra-industry trades are calculated is contained in the Appendix.
[32] The GL index as a measure of intra-industry trade has been subject to many criticisms. Menon (1994) provides a short summary of these criticisms. Despite the criticisms, however, there is no consensus as to what alternative measure is superior to it. Thus, I use the GL index to measure IIT.
[33] See for instance Cheng and Kierzkowski (2001), Jones and Kierzkowski (2001), Kimura (2001), Kleinert (2003), and Ando (2005).

probability of a PTA being formed for North-South country pairs, then this provides support for *Hypothesis 2*.[34]

According to Menon and Dixon (1996), activities in industries classified under the 3-digit SITC commodity classification tend to have similar capital and labor requirements, and so disaggregation up to this level is sufficient to capture inter- and intra-industry trade patterns. However, some studies argue that patterns of inter- and intra-industry trades may just be a purely statistical artifact due to categorical aggregation of industries.[35] To address this concern, inter- and intra-industry trades are measured using the 4-digit SITC level of commodity classification.

In addition to these four variables, X contains other possible determinants of PTA that have been recognized in the literature. The set of control variables includes both economic and political variables. This is in contrast to Baier and Bergstrand (2004), which included only economic variables as explanatory variables of PTA formation.

First, the difference in real GDP per country pair is used as a proxy for the difference in economic size. According to Michaely (1998), small countries will always prefer to form a trading agreement with a large country[36] than with a small one and that a trading agreement between a large and a small country will always generate losses for the larger country (in the absence of transfer payments)[37]. Hence, although a small country may prefer to form a trading agreement with a large country, a large country may not be willing to form a trading agreement with a small one. Thus, a trading agreement will most likely be formed between countries of

[34] Note that IIT was used to measure different things in different country pair types. This is possible since intra-industry trade occurring in North-North and North-South country pairs are due to different motivations. See the Appendix of Variables for a brief explanation.
[35] See Menon (1994) for a list of some of these studies and a short discussion about this.
[36] A larger country is expected to be less specialized, less unique, more diversified, and closer in its relative price pattern to the rest of the world, creating more trade creation opportunities for the smaller country.
[37] In reality, the larger country can demand various concessions from the small country to agree to form the agreement.

similar size. As the difference in size of two countries increases, the less likely that a large country will want to form a trading agreement with a small country.

Second, the difference in capital to labor ratio is used to account for potential trade between two countries and difference in their levels of economic development. According to standard trade theories[38], countries with dissimilar technologies or factor endowments will potentially benefit from trading with each other due to comparative advantage gains from trade. Thus, this variable is expected to be positively related to North-South PTA formation. However, Levy (1997) presented a political argument with regard to countries' factor endowments as a predictor of PTA formation. In particular, he argued that trade agreements may be politically more feasible when the disparity in factor endowments is minimal.[39] Thus, this variable may be negatively related to the probability of PTA formation.

Third, the square of the difference in capital to labor ratio is included to account for possible non-linearities. For instance, countries with more divergent capital to labor ratios may have a greater probability of forming a PTA. However, it is possible that the probability may start to fall as the divergence increases beyond a certain level.

Fourth, the difference between each country pair's financial openness is included. The Chinn and Ito (2007) Index of financial openness was used to account for a country's degree of financial openness. The difference in this index for each country pair is included to account for the possibility that countries may consider the regulations on cross-border financial transactions and degree of capital account openness of a potential partner country.[40]

---

[38] Ricardian or Heckscher-Ohlin

[39] As an anecdotal evidence, Levy (1997) compared the approval of the U.S. House and Senate on the Canadian-US Free Trade Agreement (CUSTA) and the North American Free Trade Agreement (NAFTA). The former sailed through both chambers with little controversy, but the latter became a divisive political issue.

[40] A summary of the components of the index is provided in the Appendix.

Fifth, the trade balance of each country pair is included. According to Magee (2003), countries with large bilateral trade deficit will have many lobby groups that will oppose a trading agreement. Hence, when trade is more balanced between two countries, the lesser would be the lobbying against a trading agreement and the greater is the probability that a PTA will be formed between them.

Sixth, the difference in UN (United Nations) voting patterns of a country pair with respect to the US vote is used as a political proximity variable. When a country pair supports the same policies in UN, it may be easier to form a trading agreement since political conflict may be less likely.[41]

Seventh, a dummy variable to indicate whether both countries are democracies or not is included. According to Mitra et al. (2002), democratic governments place more weight on social welfare than dictatorships do. Hence, if PTAs are welfare-improving, then when both countries have democratic governments, there is a greater probability that a PTA will be formed between them.

Eighth, a dummy variable to indicate whether a country pair shares the same language is included. Same language may represent same culture or imply ease of negotiating. Hence, countries with the same language are expected to have a greater probability of forming a PTA.

Finally, dummy variables were added to control for regional fixed effects.[42] Although distance may be sufficient to account for geographical proximity, regional dummies were added to control for peculiar regional characteristics.[43] Appendix Table 3 lists the variables considered, their corresponding definitions, and sources.

---

[41] This variable is discussed in more detail in the Appendix.
[42] I added eight regional dummies, namely, Africa, North America, Latin America, East Asia, Middle East, Other Asia, Europe, and Oceania.
[43] For instance, regional dummies may capture differences in infrastructure and natural resources across regions.

The hypothesis that the relative importance of the factors affecting PTA formation may be different for each country pair is first tested. To be able to distinguish the country pairs, countries were first classified into North and South. The classification was based on the average human development index (HDI) rating of the countries from 1980-2000.[44] Countries with HDI rating of 0.80 and above are classified as North. The rest are classified as South. Appendix Table 4 lists the countries under each classification. Using this classification, there are 41 countries classified as North and 94 countries classified as South. All country pairs were initially pooled and dummy variables, CP_i (i = NN, NS, SS), were assigned to the different country pairs. Using North-North as the base category (North-South and South-South country pairs are used as well as the base categories to confirm the results), the following dummy variables are defined:

(16)
$$CP_{NS} = \begin{cases} 1, & \text{if North-South country pair} \\ 0, & \text{otherwise} \end{cases}$$

$$CP_{SS} = \begin{cases} 1, & \text{if South-South country pair} \\ 0, & \text{otherwise} \end{cases}$$

These dummy variables were then interacted with all elements of X.[45] Introducing the interaction terms and dummy variables, results in the following estimating equation:

(17) $PTA^* = \alpha + CP_{NS} + CP_{SS} + X\beta + CP_{NS} * X\beta + CP_{SS} * X\beta + \varepsilon.$

CP_{NS} and CP_{SS} represent the change in intercept relative to the base category, while the interaction terms represent the change in slope relative to the base category. Equation (17) is estimated using probit. If the interaction terms are significant, then a support is found for *Hypothesis 1*. Therefore, it is worthwhile to estimate the following for each country pair and compare their corresponding β's:

[44] I use HDI as the basis of classifying countries since it is the most accepted classification of developed and developing countries since it measures development beyond income.
[45] Except for the regional dummies

(18) $PTA^* = \alpha + X\beta + \varepsilon$

Though many existing PTAs are multilateral, similar to other studies, the decision to enter a PTA is treated as bilateral. The reason for this is that every country in a PTA is assumed to decide bilaterally whether the net national welfare gain from a PTA with another country warrants formation. In addition, as Baier and Bergstrand point out, every country in an existing PTA has the ability to veto the addition of another country in a PTA.

In specifying the estimating equation, most studies use contemporaneous variables to explain PTA formation. However, several issues arise when contemporaneous explanatory variables are used. First is the problem of reverse causality. For instance, if total bilateral trade in year t is used to explain PTA formation in year t and a positive relationship is found, one cannot be really sure which way the causality proceeds. It is highly probable that PTA formation could have enhanced the volume of trade. Second is the reality that PTA formation in a given year cannot be really attributed to factors[46] in that same year. The reason for this is the fact that a PTA takes years to negotiate. Even when countries start negotiating in a given year, the factors that could have prompted them to start negotiations may not even be the factors on the same year.[47]

Above issues are addressed by using past values of explanatory variables. A year for the explanatory variables, say t-s, is chosen to explain PTAs formed by year t. In addition, country pairs that already have a PTA in year t-s are excluded from the sample. Thus, the estimates will show the effect of year t-s characteristics on the probability that a pair of countries without a PTA in year t-s will choose each other as partners in a PTA over the next s years.[48]

---

[46] Time-varying factors
[47] For instance, Baier and Bergstrand argued that the European Economic Community was negotiated over 10 years.
[48] Several other studies have done this. For instance, Magee (2003), and Baier and Bergstrand (2004).

An examination of the growth rates of PTAs from 1980-2006 (See Appendix Figure 1) shows different patterns of growth before and after 1995, implying a structural break. Based on this, it can be inferred that the relative importance of the factors that have affected PTA formation prior to 1995 and thereafter are different. Hence, the sample is divided into two periods. First, the effect of 1980 characteristics on the probability that a pair of countries without a PTA in 1980 will have one by 1995 is examined.[49] There are 3,900 North-South, 778 North-North, and 4,242 South-South country pair observations used to predict 1995 PTA formation. Second, the effect of 1995 characteristics on the probability that a pair of countries without a PTA in 1995 will have one by 2006 is examined. There are 3,770 North-South, 650 North-North, and 4,062 South-South country pair observations used to predict 2006 PTA formation.[50] Appendix Table 5 presents the summary statistics for each of the country pairs for both periods.

The aforementioned suggests that PTA formation from 1980-2006 may be modeled as a sequential decision making process. The probabilities for the two periods are determined as follows:

$$P_1 = F(\beta_1 X)$$

$$P_2 = [1 - F(\beta_1 X)] F(\beta_2 X)$$

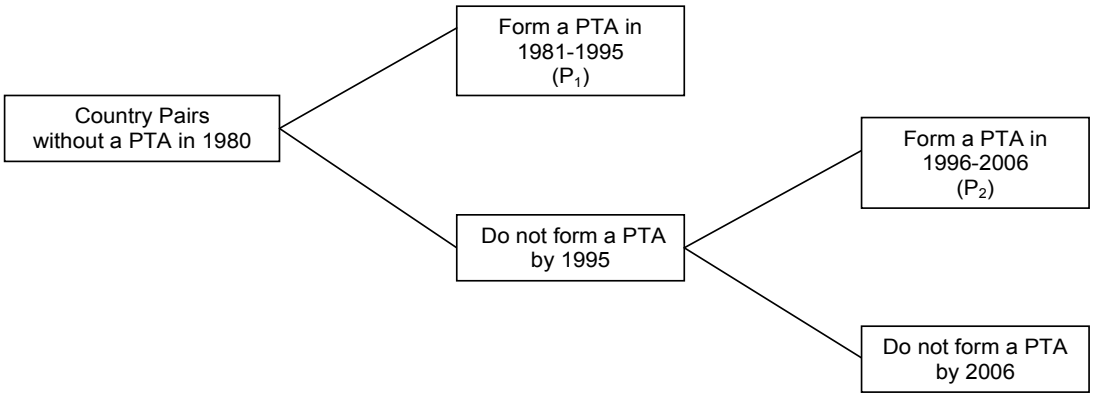
where F represents the standard normal distribution function; and β_1 and β_2 are vectors of the model parameters. Vector X contains the explanatory variables. β_1 is estimated over the entire sample, while β_2 is estimated over the sample of country pairs that do not have a PTA in 1995. A sequential probit can be simply estimated as binary probit by appropriately choosing the samples

[49] 1980 is used as the starting year of the study due to data constraints. The PTAs formed prior to 1980 and are therefore excluded in the regressions are: EC (Treaty of Rome); EFTA (Stockholm Convention); CACM; TRIPARTITE; EFTA Accession of Ireland,; EC-OCTs; PYN; GSTP; EC Accession of Denmark, Ireland, and UK; EC-Switzerland and Liechtenstein; EC-Iceland; EC-Norway; CARICOM; EC-Algeria; Bangkok Agreement; PATCRA; EC-Syria.

[50] Refer back to Appendix Table 4 for a breakdown of country pairs.

in each period. For the first period, the probability that a pair of countries without a PTA in 1980 will form one by 1995 is estimated; and for the second period, the probability that a pair of countries without a PTA in 1995 will form one by 2006 is estimated. Figure 1 portrays the sequential decision making process and indicates the samples on which the estimation of each period occurs.

Figure 1. PTA Formation in 1980-2006 as a Sequential Process



Aforementioned methodology has limitations since I am unable to fully account for dynamic factors. There may be factors in other years that could have prompted countries to form PTAs in succeeding years, but such factors are not captured in the specification. For instance, one may argue that the uncertainties in the Uruguay Round may have caused the dramatic growth in PTAs prior to 1995. While this may be true, my methodology will be adequate to address my hypotheses. In the face of an impasse of multilateral negotiations, my methodology will be able to tell how countries chose their partners and what factors make countries choose particular countries over others. In addition, my specification may not be able to capture all relevant factors that have prompted PTA formation. For instance, the impact of the 1997-1998 financial crises is not captured in the specification, but could have influenced countries to seek

PTAs. To possibly address this, a financial openness variable is added to at least take into account the financial side of the economy. I proceed with the caveat in mind that not all relevant factors are captured by my methodology and model specification.

V. Results

A. Pooled Sample

Table 2. Test of Difference in Coefficients across Country Pairs

	(1)	(2)	(3)	(4)	(5)	(6)
Base Category	NN		NS		SS	
Is the coefficient for this country pair significantly different from the base category?	NS	SS	NN	SS	NN	NS
Panel A. PTAs formed from 1981-1995						
Distance	yes	yes	yes	yes	yes	yes
Total Bilateral Trade	yes	yes	yes	no	yes	no
Inter-industry Trade	yes	yes	yes	no	no	no
Intra-industry Trade	yes	yes	yes	no	yes	no
Panel B. PTAs formed from 1996-2006						
Distance	yes	no	yes	yes	no	yes
Total Bilateral Trade	no	no	no	yes	no	yes
Inter-industry Trade	no	no	no	yes	yes	yes
Intra-industry Trade	yes	yes	yes	yes	yes	yes

Table 2 summarizes the results of pooling all countries in a single estimation. The question of interest is whether a given coefficient for a given country pair is significantly different from the chosen base country pair. Columns 1 and 2 use North-North country pair as the base category, Columns 3 and 4 use North-South, and Columns 5 and 6 use South-South.[51] Panel A tests the difference of coefficients for PTAs formed from 1981-1995, while Panel B tests for those PTAs formed from 1996-2006. If the coefficient of interest for a given country pair is

[51] Apart from the control variables, the estimating equation includes two variables of interest at a time only. For instance, one estimation includes distance and total bilateral trade only, aside from the other X explanatory variables. Another includes distance and inter-industry trade only and another includes distance and intra-industry trade only.

significantly different from that of the base country pair at 10% level of significance, *yes* is indicated in the corresponding cell, otherwise *no* is indicated.

For PTAs formed from 1980 to 1995, Panel A consistently reveals that the weight of *distance* on the probability of PTA formation is significantly different across the three country pairs regardless of the base category used. Likewise, the coefficient of *total bilateral trade* is significantly different across country pairs, except for North-South and South-South country pairs, as seen in columns (4) and (6). When *total bilateral trade* is disaggregated into *inter-* and *intra-industry trades*, there is some evidence that the impact of *inter- and intra-industry trades* in driving PTA formation are significantly different across the three country pairs. However, it is apparent that the effect of intra-industry trade for North-South and South-South PTAs are not significantly different from each other, as seen in Columns (4) and (6). The results in Panel A lend some support to the hypothesis that the role of trading relationship on PTA formation varies per country pair.

When PTAs formed from 1996-2006 are considered, a quite different picture is revealed. The impact of *distance* on the probability of PTA formation is still significantly different across the three country pairs, except for its impact on North-North and South-South country pairs, as seen in columns (2) and (5). The coefficient of *total bilateral trade* is not significantly different for the three country pairs, except for North-South and South-South country pairs, as seen in columns (4) and (6). Disaggregating *total bilateral trade* into *inter-* and *intra-industry trades* shows some support for the hypothesis that the role of trading relationship across country pairs is different. This is especially apparent for the coefficient of *intra-industry trade*, which shows that its impact on the probability of PTA formation is significantly different across the three country pairs regardless of the base category used.

The results in Panels A and B reveal that not only is there evidence that the role of *distance, total bilateral, inter-, and intra-industry trades* on PTA formation differ across country pairs in a single period, but that the importance of these factors are different for each period. For both periods considered, disaggregating total bilateral trade into inter-and intra-industry trades shows support for the hypothesis that the impact of trading relationship as a factor driving PTA formation is different across country pairs.

B. Disaggregated Sample

Table 3. Mean of Distance and Trade Variables

Country Pairs	1980			1995		
	All Country Pairs	Countries with PTA*=0	Countries with PTA*=1	All Country Pairs	Countries with PTA*=0	Countries with PTA*=1
North-North						
Distance (in log)	1.8279	2.0781	0.4251	2.0781	2.1046	1.4484
Total Bilateral Trade (in log)	9.5642	9.0576	12.4039	9.9749	9.8508	12.9143
Net Trade (in log)	9.6939	9.2246	12.3241	10.178	10.070	12.7411
Intra-Industry Trade Index	0.0553	0.0380	0.1518	0.0739	0.0689	0.1933
North-South						
Distance (in log)	1.9582	1.9956	0.6933	1.9956	2.0122	1.5124
Total Bilateral Trade (in log)	6.3444	6.2265	8.9752	7.0742	6.9032	12.0408
Net Trade (in log)	6.6044	6.5380	8.8477	7.4251	7.2694	11.9494
Intra-Industry Trade Index	0.0121	0.0113	0.0563	0.0241	0.0224	0.0736
South-South						
Distance (in log)	1.8645	1.9181	0.6552	1.9181	1.9397	0.2544
Total Bilateral Trade (in log)	2.6314	2.5114	5.3371	3.3168	3.2987	4.7060
Net Trade (in log)	2.7447	2.5978	6.0593	3.6737	3.6589	4.8081
Intra-Industry Trade Index	0.0135	0.0134	0.0144	0.0215	0.0214	0.0253

Before presenting the results, it is worthwhile to describe the characteristics of the different country pairs. Table 3 presents the means of each country pair for distance and the trade variables. For the period 1980-1995, it is noticeable that the mean distance of the country pairs that formed PTAs in this period is well below the mean of those that did not form a PTA. For the period 1996-2006, except for South-South country pairs, the mean distance of country pairs that formed PTAs increased, suggesting that some countries may have already exhausted

their proximate neighboring countries as PTA partners in the earlier period. Nevertheless, similar as in the earlier period, the mean distance of countries that have formed PTAs is still way below the mean of those that did not form a PTA. For the trade variables, the averages for the country pairs that have formed PTAs are higher than those that did not form a PTA. This is true for all country pairs and periods. An exception is the intra-industry trade index for SS country pairs. The mean for the countries that did not form and formed PTAs are almost equal, suggesting that intra-industry trade may not be a significant factor for SS PTA formation.

Table 4 and Appendix Table 6 show the results of the sequential probit estimations. In both tables, columns (1)-(3) contain results for North-North country pairs, columns (4)-(6) for North-South country pairs, and columns (7)-(9) for South-South country pairs. Among the variables of concern, Table 4, columns (1), (4), and (7) consider distance and total bilateral trade; columns (2), (5), and (8) consider distance and inter-industry trade; and columns (3), (6), and (9) consider distance and intra-industry trade. All specifications are estimated with control variables, coefficient estimates of which are listed in Appendix Table 6. Interpreting the probit coefficients requires evaluating them at certain values of the explanatory variables. I follow the convention[52] and evaluate the marginal effects based on the mean values of the explanatory variables.

Table 4 Panel A shows the impact of 1980 variables on the probability that a country pair without a PTA in 1980 will have one by 1995, while Panel B shows the impact of 1995 variables on the probability that a country pair without a PTA in 1995 will have one by 2006. For any country pair, distance is statistically significant and decreases the probability that a PTA will be formed, as expected. For PTAs formed from 1980 to 1995 (Panel A), a 10 percent increase in distance will decrease the probability that a North country will seek another North country by

[52] Wooldridge (2002), Freese and Long (2006)

Table 4. Impact of Distance and Trade Variables on PTA Formation
Using Sequential Probit

	NN			NS			SS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: PTA formed form 1981-1995								
Distance	-0.0181**	-0.0149**	-0.0200**	-0.0043**	-0.0048**	-0.0050**	-0.0240**	-0.0213**	-0.0270**
	(0.189)	(0.194)	(0.184)	(0.082)	(0.082)	(0.083)	(0.053)	(0.054)	(0.052)
Total Bilateral Trade	0.0013**			0.0003**			0.0020**		
	(0.045)			(0.015)			(0.013)		
Inter-industry Trade		0.0012**			0.0002**			0.0021**	
		(0.046)			(0.016)			(0.010)	
Intra-industry Trade			0.0304**			-0.0010			-0.0279
			(0.993)			(0.939)			(2.051)
Overall Percent Correctly Predicted	96.83	97.13	96.23	97.46	97.43	97.46	95.59	95.74	95.69
Positive Predictive Value (P*=1)	91.30	91.45	94.87	55.56	54.55	56.25	42.50	50.00	46.88
Negative Predictive Value (P*=0)	97.99	98.35	99.08	97.89	97.83	97.83	96.12	96.19	96.08
R^2 (McKelvey and Zavoina's)	0.867	0.873	0.959	0.669	0.665	0.692	0.358	0.387	0.353
	Panel B: PTA formed form 1996-2006								
Distance	-0.0248**	-0.0265**	-0.0248**	-0.0046**	-0.0050**	-0.0057**	-0.0010**	-0.0010**	-0.0013**
	(0.176)	(0.174)	(0.177)	(0.071)	(0.070)	(0.067)	(0.095)	(0.094)	(0.094)
Total Bilateral Trade	0.0033**			0.0012**			0.0001**		
	(0.037)			(0.019)			(0.024)		
Inter-industry Trade		0.0029**			0.0012**			0.0001*	
		(0.034)			(0.019)			(0.022)	
Intra-industry Trade			0.1236**			0.0312**			-0.0044
			(1.025)			(0.612)			(3.237)
Percentage Correctly Predicted	95.06	94.70	95.25	96.62	96.53	96.33	98.72	98.72	98.77
Positive Predictive Value (P*=1)	50.00	25.00	57.14	64.29	59.26	45.45	60.00	60.00	80.00
Negative Predictive Value (P*=0)	95.56	95.21	95.74	96.88	96.82	96.65	98.76	98.76	98.79
R^2 (McKelvey and Zavoina's)	0.494	0.483	0.471	0.581	0.575	0.515	0.502	0.501	0.483

Notes: Reported coefficeints are marginal effects. ** and * indicate statistical significance at 5% level and 10% level, respectively.
Values in ( ) are standard errors.

about 15-20 percent as seen in columns (1)-(3) and a South country by about 5 percent as seen in columns (4)-(6). This suggests that North countries are more sensitive to distance when they choose another North country as a partner than a South country. A possible reason for this is that North-South country pairs, on average, are more distant from each other, as seen in Table 3. Meanwhile, a 10 percent increase in distance will decrease the probability that a South country will form a PTA with another South country by about 21-27 percent, as seen in columns (7)-(9). This is in line with expectations that South countries should be more sensitive to distance when

they seek another South country as a partner over a North since any gains from trade with another South country may be outweighed by costs associated with distance. Thus, support is found for *Hypothesis 1(ii)*. In addition, it is apparent that the impact of distance for the period 1980-1995 is not similar across country pairs, which is consistent with the findings in Table 2 that the impact of distance for said period is significantly different across country pairs.

Looking at the trade variables in Panel A, total bilateral trade and inter-industry trade are significant for all country pairs, but intra-industry trade is statistically significant only for North-North country pairs. A 10 percent increase in total bilateral trade will increase the probability that a North-North, North-South, and South-South PTA will be formed by 1.3 percent, 0.3 percent and 2 percent, respectively. This suggests that country pairs that have trading relationship in 1980 have greater probability of forming a PTA by 1995.

A 10 percent increase in inter-industry trade, meanwhile, will increase the probability of PTA formation for North-North country pairs by 1.2 percent, North-South country pairs by 0.2 percent, and South-South country pairs by 2.1 percent. These results are inconsistent with the hypothesis that inter-industry trade should have more weight in North-South PTA formation compared to North-North and South-South PTAs. However, it is noteworthy that the impacts of both total bilateral and inter-industry trades are greatest for South-South country pairs.

A 10 unit increase in the intra-industry trade index increases the probability that North-North country pairs will form a PTA by 30.4 percent. Intra-industry trade is not a significant predictor of North-South and South-South PTAs formed prior to 1995. This is consistent with the findings in Table 2 that the impact of intra-industry trade is not significantly different for North-South and South-South country pairs. In addition, these results support the hypothesis that the impact of intra-industry trade on PTA formation is largest for North-North country pairs and should have no impact for South-South country pairs. The insignificance of intra-industry for

North-South country pairs may be a manifestation that international product fragmentation is not prevalent over the time period considered. Thus, mixed support is found for *Hypothesis 1(i),* but no support is found for *Hypothesis 2.*

The impact of other variables on PTA formation is displayed in Appendix Table 6. Panel A, columns (1)-(3) show that as the difference in market size and trade balance decrease and when both countries are democratic, there is a greater probability that a North-North country pair will form a PTA. The impacts of these variables are more economically significant than total bilateral and inter-industry trades. Only intra-industry trade is more economically significant than any other control variable.

For North-South country pairs, only the difference in financial openness, political proximity and government type are insignificant as seen in Panel A, columns (4)-(6). In contrast to North-North country pairs,[53] as the capital-to-labor ratios of North-South country pairs become more divergent, the greater is the probability that a PTA will be formed between them. The impact of the difference in capital-to-labor ratios is more economically significant than the trade variables, implying that though North-South country pairs that have a history of trading have a greater probability of forming a PTA, potential trade due to comparative advantage gains may be more important. In addition, it is notable that the impact of the same language dummy is economically more significant than any variable.

For South-South country pairs, all control variables, except for the difference in market size and capital-to-labor ratios, have significant impact on the decision to form a PTA, as seen in Panel A, columns (7) to (9). It is noticeable that among the explanatory variables, political proximity has the most economically significant impact in the decision to form a South-South PTA. In particular, South countries that have the same political preferences have a greater

[53] And South-South country pairs, as will be discussed.

probability of forming a PTA with each other. Noteworthy also is that among the three country pairs, political proximity is only statistically significant for South-South country pairs. This suggests that South-South PTAs are very political in nature.

Table 4, Panel B shows the impact of distance and 1995 trade variables on the probability that a country pair will have a PTA by 2006. Distance remains to be significant for all country pairs. However, the impact of distance has markedly decreased for South-South country pairs. A 10 percent increase in distance will only decrease the probability of South-South PTA formation by about 1 percent. For North-South country pairs, the impact of distance is similar to the previous period, such that a 10 percent increase in distance will decrease the probability of North-South PTA formation by about 5 percent. For North-North country pairs, the impact of distance increased, such that a 10 percent increase in distance will decrease the probability of North-North PTA formation by about 25 percent. Results are inconsistent with expectations that the impact of distance should be greatest for South-South country pairs. Nevertheless, the findings are consistent with those in Table 2 that the impact of distance is different across country pairs. Thus, there is mixed support for *Hypothesis 1(ii)*.

Inspection of the trade variables in Panel B reveals that total bilateral trade remains to be a statistically significant factor in influencing PTAs formed after 1995 for all country pairs. A 10 percent increase in total bilateral trade will increase the probability that North-North, North-South, and South-South country pairs will form a PTA by 3.3, 1.2, and 0.1 percent, respectively. Disaggregating total bilateral trade into inter- and intra-industry trades reveals more insights. A 10 percent increase in inter-industry trade will increase the probability that North-North country pairs will form a PTA by 2.9 percent, North-South country pairs by 1.2 percent and South-South country pairs by 0.1 percent. This is inconsistent with expectations that inter-industry trade should be most significant for North-South country pairs. However, the findings are consistent

with Table 2 that the impact of total bilateral trade and inter-industry trade are different across country pairs. Intra-industry trade, meanwhile, is a very significant predictor of North-North PTAs, such that a 10 unit increase in the intra-industry trade index increases the probability of PTA formation by over 100 percent. For North-South country pairs, intra-industry trade has become a significant predictor of PTA formation, such that a 10 unit increase in the intra-industry trade index increases the probability of PTA formation by 31.2 percent. It remains insignificant for South-South country pairs, as expected. It is noteworthy that the impact of intra-industry trade is economically very significant for both North-North and North-South country pairs compared to the impact of other explanatory variables as seen in Appendix Table 6. In addition, for North-North and North-South country pairs, it is noticeable that all trade variables have a greater role in explaining PTA formation in the period 1995-2006 compared to 1980-1995. This is in contrast to South-South country pairs, where the impact of all trade variables declined in both statistical and economic significance for the period 1995-2006.

The aforementioned gives mixed support for *Hypothesis 1(i)*. In addition, the significant and positive impact of intra-industry trade on the probability of North-South PTA formation supports *Hypothesis 2*. Since *Hypothesis 2* found no support for the period prior to 1995, this suggests that international product fragmentation has only influenced North-South PTA formation after 1995.

For the control variables, Appendix Table 6, Panel B shows that for North-North country pairs, only the difference in market size and financial openness have statistically significant impact on PTA formation. For North-South country pairs, all control variables are statistically significant. For South-South country pairs, only the differences in market size and financial openness, and same language dummy have statistically significant impact on PTA formation.

To assess the predictive power of the model, I compared the observed and predicted values for each outcome. At the bottom of each panel in Table 4, *Percent Correctly Predicted* refers to the total percentage of country pairs correctly classified by the model as having formed or not formed a PTA relative to the actual observations. *Positive Predictive Value* refers to the percentage of observations correctly classified by the model as having a positive outcome relative to the actual observations with positive outcome (P*=1) and *Negative Predictive Value* refers to the percentage of observations correctly classified by the model as having a negative outcome relative to the actual observations with negative outcome (P*=0). Also listed at the bottom of each panel is McKelvey and Zavoina's R^2. The latter explains the proportion of the variability in the dependent variable explained by the model and accounts for the correlation between the model's predicted values and actual values (Long, 1997).[54]

For the period 1980-1995, the model has the highest *Positive Predictive Value* for North-North country pairs (91-95 percent) and least for South-South country pairs (42-50 percent). *Negative Predictive Value* and *Percent Correctly Predicted* for all country pairs are fairly high and ranges from 96-99 percent. McKelvey and Zavoina's R^2, meanwhile, suggests that the model explains about 86-96 percent, 67-69 percent, and 36-39 percent of the variability in the decision to form North-North, North-South, and South-South PTAs, respectively. For the period 1996-2006, the model has the highest *Positive Predictive Value* for South-South country pairs (60-80 percent) and least for North-North country pairs (25-57 percent). The model explains about 47-50 percent, 51-58 percent, and 48-50 percent of the variability in the decision to form North-North, North-South, and South-South PTAs, respectively, as suggested by McKelvey and Zavoina's R^2.

[54] Its calculations are based on predicting a continuous latent variable underlying the observed 0-1 outcome in the data. According to Hagle and Mitchell (1992) and Windmeijer (1995), McKelvey and Zavoina's R^2 closely approximates the R^2 obtained by fitting the linear regression model on the underlying latent variable (Freese and Long, 2006).

C. Robustness Check

To check the robustness of results I estimate equation (18) using multinomial probit, where three possible outcomes for a country pair are possible, given by

$$\Delta PTA = \begin{cases} 0, & \text{if a PTA is not formed by a country pair in any period} \\ 1, & \text{if a PTA was formed by a country pair between 1980 and 1995} \\ 2, & \text{if a PTA was formed by a country pair between 1996 and 2006} \end{cases}$$

The obvious choice as the base outcome is 0. In the multinomial probit estimation, 1980 characteristics are used to explain PTA formation for both periods. In contrast to sequential probit estimation, where each binary probit estimation is based on a different sample, in multinomial probit, each outcome is based on the same sample. However, multinomial probit has computational difficulties, and is therefore rarely used in practice. An alternative is to use multinomial logit, which is faster to implement. According to Freese and Long (2006), since multinomial logit and multinomial probit produce nearly identical predictions, then the former should be used instead of the latter.[55]

Results of multinomial logit estimations are presented in Table 5. Panels A, B, and C show results for North-North, North-South, and South-South country pairs, respectively. In each column, *Outcomes 1*and *2* display the impact of 1980 variables on the probability that a country pair will have a PTA by 1995 and 2006, respectively. Column (1) presents the coefficient estimates for distance and total bilateral trade; column (2) for distance and inter-industry trade; and column (3) for distance and intra-industry trade.

[55] According to Freese and Long (2006), it is harder to fit models using multinomial probit because it computes integrals by Gaussian quadrature.

Table 5. Impact of Distance and Trade Variables on PTA Formation Using Multinomial Logit

	(1)		(2)		(3)	
	Outcome 1	*Outcome 2*	*Outcome 1*	*Outcome 2*	*Outcome 1*	*Outcome 2*
	Panel A. North-North					
Distance	-0.0099**	-0.0001**	-0.0088**	-0.0001**	-0.0182**	-0.0001**
	(0.537)	(0.340)	(0.542)	(0.344)	(0.482)	(0.343)
Total Bilateral Trade	0.0010**	0.0001**				
	(0.109)	(0.066)				
Inter-industry Trade			0.0008**	0.0001*		
			(0.108)	(0.069)		
Intra-industry Trade					0.0295**	0.0004**
					(2.691)	(2.607)
Adjusted Count R^2	0.940		0.941		0.938	
	Panel B. North-South					
Distance	-0.0981**	-0.0045**	-0.1026**	-0.0048**	-0.1362**	-0.0097**
	(0.248)	(0.204)	(0.248)	(0.203)	(0.255)	(0.198)
Total Bilateral Trade	0.0077**	0.0014**				
	(0.041)	(0.042)				
Inter-industry Trade			0.0070**	0.0016**		
			(0.041)	(0.046)		
Intra-industry Trade					0.0174	0.0205
					(0.209)	(1.673)
Adjusted Count R^2	0.955		0.954		0.950	
	Panel C. South-South					
Distance	-0.1397**	-0.0002**	-0.1303**	-0.0003**	-0.1823**	-0.0003**
	(0.107)	(0.212)	(0.108)	(0.208)	(0.105)	(0.211)
Total Bilateral Trade	0.0124**	0.0001**				
	(0.026)	(0.046)				
Inter-industry Trade			0.0129**	0.0001		
			(0.021)	(0.036)		
Intra-industry Trade					-0.3862	-0.0004
					(4.200)	(6.973)
Adjusted Count R^2	0.944		0.944		0.944	

Notes: *Outcome 1* refers to PTA formation in 1980-1995, while *Outcome 2* refers to PTA formation in 1996-2006.
Reported coefficeints are marginal effects. All estimations are done with the same control varibles as listed in Appendix Table 6, but coefficient estimates are not reported for brevity purposes.
** and * indicate statistical significance at 5% level and 10% level, repsectively.
Values in ( ) are standard errors.

Though the magnitudes of the variables computed under sequential probit and multinomial logit are not directly comparable, the statistical and economic significance of the trade variables derived using multinomial logit give similar implications as those derived using sequential probit estimations. For PTAs formed from 1980-1995 (*Outcome 1*), distance has the greatest impact for South-South country pairs and least for North-North country pairs.

For the trade variables, the implications of the magnitude and significance of the variables are similar to those in Table 4.

For PTAs formed from 1996-2006 (*Outcome 2*), distance remains to be significant, such that an increase in distance will decrease the probability of PTA formation between any country pair. For the trade variables, while their statistical significance is similar to those in Table 4, their economic impact is almost nil. Noticeable also is the insignificance of intra-industry trade for North-South country pairs. These imply that 1980 trade variables provide weak explanatory power for PTAs formed in the period 1996-2006. This may suggest that 1980 trade relationship is too distant to be considered as an important factor in the decision to form a PTA in 1996-2006 and that more recent trading relationship may be more important.

For multinomial logit estimation, McKelvey and Zavoina's R^2 is not calculated. Thus, to assess the predictive power of the multinomial logit model, I use the Adjusted Count R^2, which calculates the proportion of correct predictions. Based on this measure, the multinomial logit estimation gives about 95 percent correct predictions for all country pairs.

Next, instead of just letting distance be equal to the mean when evaluating the marginal effects, I assumed that the distance between country pairs increases from the sample minimum to 2,000 miles and I obtained the change in the probability of PTA formation from such an increase. Results are shown in Table 6. Such an increase dramatically decreases the probability of PTA formation for all country pairs for the period 1980-1995. This is consistent with the actual data that countries that form PTAs have distances less than the sample mean.[56] When the trade variables are set equal to their means and all countries are assumed to be 2,000 miles apart from each other, the trade variables have minimal impact on PTA formation, as seen in rows that display *marginal effect*. Again, this is consistent with actual data – country pairs with only

[56] Which is less than 2,000 miles

average trade do not form PTAs, especially so if they are distant from each other. Increasing the values of the trade variables from the minimum to maximum raises the probability of PTA formation for North-North and South-South country pairs, as seen in the rows that display *minimum to maximum value*. This implies that greater trading relationship can partially offset the negative impact of the increase in distance on the probability of PTA formation.

Table 6. Impact of Distance and Trade Variables on PTA Formation with Increased Distance

	NN			NS			SS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: PTA formed form 1981-1995								
Distance[a]	-0.993**	-0.994**	-0.763**	-0.933**	-0.941**	-0.975**	-0.687**	-0.682**	-0.761**
Total Bilateral Trade[b]									
marginal effect	0.002**			0.001**			0.003**		
minimum to maximum value	0.070**			0.002**			0.079**		
Inter-industry Trade[b]									
marginal effect		0.002**			0.001**			0.003**	
minimum to maximum value		0.072**			0.001*			0.099**	
Intra-industry Trade[b]									
marginal effect			0.000**			-0.002*			-0.036
minimum to maximum value			0.001**			-0.001*			-0.014
	Panel B: PTA formed form 1996-2006								
Distance[a]	-0.574**	-0.564**	-0.522**	-0.291**	-0.294**	-0.344**	-0.231**	-0.245**	-0.272**
Total Bilateral Trade[b]									
marginal effect	0.007**			0.002**			0.000**		
minimum to maximum value	0.157**			0.151**			0.001**		
Inter-industry Trade[b]									
marginal effect		0.005**			0.002**			0.000*	
minimum to maximum value		0.106**			0.115**			0.001**	
Intra-industry Trade[b]									
marginal effect			0.229**			0.045**			-0.006
minimum to maximum value			0.496**			0.168**			-0.001

Notes: a - Distance is assumed to increase from the sub-sample minimum to 2,000 miles. Other variables are set equal to their means.
b - Reported coefficeints are either the marginal effects or the change in probability when the variable changes from its minimum to maximum value. Distance is set equal to 2,000 miles.
All estimations are done with the same control varibles as listed in Appendix Table 6, but coefficient estimates are not reported for brevity purposes.
** and * indicate statistical significance at 5% level and 10% level, respectively.

For the period 1996-2006, increasing distance from the sample minimum to 2,000 miles decreases PTA formation, but the impact is not as dramatic as that in the earlier period. Increasing the values of the trade variables from the minimum to the maximum increases the

probability of PTA formation for both North-North and North-South country pairs. Again, this suggests that greater trading relationship can partially offset the negative impact of the increase in distance on PTA formation. However, this is not the case for South-South country pairs, implying that factors other than the trading relationship are more important when South countries decide to form a PTA with each other.[57] This confirms earlier findings that South-South country pairs may be highly political in nature.[58]

VI. Conclusion

This study found that additional insights on PTA formation could be gained from separating North-South, North-North, and South-South country pairs. First, countries choose PTA partners that are geographically proximate to them, which support the natural trading partner hypothesis. Though geographical proximity is significant for PTA formation for all country pairs, its impact is different across country pairs and periods. Second, most countries choose PTA partners with which they have a history of trading, which supports the natural trading partners hypothesis. This suggests that PTAs are formed by countries in order to

[57] This holds even when distance is set equal to 1,000 miles and trade variables are increased from the minimum to the maximum value.

[58] Additional regressions were also done including dummy variables to countries that are members of well-known trading blocs – EC, COMESA, MERCOSUR, NAFTA, and ASEAN, since it is possible that countries seek them as PTA partners because they are members of these trading blocs. However, they are insignificant and there were no significant changes in the results. An obvious reason would be that these are regional PTAs; hence, including them is akin to adding regional dummy variables, which I have already done in all the specifications. Additional robustness check was done by using World Bank's classification of developed (high-income) and developing (medium and low-income) countries based on gross national income per capita instead of HDI as the classification of North and South countries. Doing so resulted in reclassification of five North countries to South, namely, Argentina, Hungary, Saint Kitts and Nevis, Seychelles, and Uruguay. No major changes were seen; thus, results are not reported. An attempt was made to consider only bilateral PTAs in the estimation. However, I did not proceed with such estimation due to the very small number of country pairs with PTA*=1 if only bilateral PTAs are considered. In addition, most countries that have bilateral trade agreements belong to the Post-Soviet States, which are not included in my sample of countries. Finally, a dummy variable equal to 1 was included in regressions if at least one of the countries in a country pair had a financial crisis in the periods 1981-1995 and 1996-2006; and equal to 0, otherwise. The dummy variable was insignificant for all country pairs for the period 1981-1995. It is significant for both North-South and South-South country pairs for the period 1996-2006. However, results are not reported since adding the dummy does not alter the implications of the reported findings.

strengthen the already existing trading relationship and not necessarily to dramatically increase the volume of trade. If this is the case, the fear of trade diversion brought by the influx of PTAs may have been over emphasized. However, to make a definite claim on this requires empirical verification, which I leave for future research. Third, the importance of inter- and intra-industry trades differs across country pairs. While inter-industry trade is mostly significant for all country pairs, intra-industry has a positive impact only for North-South and North-North country pairs.

In addition, in contrast to previous studies that have analyzed trade policy from the point of view of import-competing firms, using a simple model, this study has demonstrated that trade protection is not the necessary outcome when trade policy formulation considers exporters and domestic firms that use imported inputs. In particular, this study has shown that international product fragmentation can positively influence the formation of North-South PTAs. I claim that the significance of intra-industry trade for North-South country pairs is due to international product fragmentation. This supports the proposition put forth that the developments in international division of labor have contributed to the formation of North-South PTAs. Moreover, this suggests that North-South PTAs are formed to secure existing trading relationship. In particular, forming a PTA with a North country may be a way by which a South country tries to gain greater competitiveness in the former's market over other South countries.

Results suggest that WTO rules should recognize the increasing importance of internationalization of production. This is important as internationalization of production has contributed to the increased trade disputes over the past years. As Baldwin (2001) points out, much of the petitions on unfair trade practices received by the WTO concern trade in intermediate inputs, but the procedures set forth in the WTO for dealing with these petitions are based on a trading world where all inputs to production of a final good are produced domestically. Moreover, internationalization of production has made rules of origin (ROO) more

controversial. Harilal and Beena (2003) pointed out that the proliferation of PTAs has been accompanied by proliferation of ROO. ROO under PTAs are exempt from WTO's agreement on ROO. Since a country can join an unlimited number of PTAs, this implies that a country can likewise have numerous ROO, as it can have a unique one for each PTA. Whether countries can effectively monitor compliance for each PTA and whether ROO are consistent with each can cause many potential problems. Finally, the proliferation of PTAs even among geographically distant countries suggest that countries find it easier to negotiate among themselves than to rely on the multilateral regime of WTO.

Appendix: Description of Some Control Variables

1. Inter-industry Trade

This variable is computed as:
$\sum_r \left| Ex_{hf,r} - \mathrm{Im}_{hf,r} \right|$
where $Ex_{hf,r}$ is the total value of exports in industry *r* from country *h* to *f*; and $\mathrm{Im}_{hf,r}$ is the total value of imports in industry *r* of country *h* from *f*. Industry *r* is defined by the four-digit SITC level of commodity classification.

2. Grubel-Lloyd Intra-industry Trade Index

This variable is computed as:
$1 - \left\{ \sum_r \left| Ex_{hf,r} - \mathrm{Im}_{hf,r} \right| / \left(Ex_{hf,r} - \mathrm{Im}_{hf,r} \right) \right\}$
where $Ex_{hf,r}$ is the total value of exports in industry *r* from country *h* to *f*; and $\mathrm{Im}_{hf,r}$ is the total value of imports in industry *r* of country *h* from *f*. Industry *r* is defined by the four-digit SITC level of commodity classification.

This simple index measures both horizontal and vertical IIT. Horizontal IIT arises from horizontal product differentiation, where products are different because of certain attributes, but are fundamentally the same in terms of quality, cost, and technology employed in their production. Monopolistic competition models with the existence of economies of scale in a differentiated product explain horizontal IIT.[59] Such type of trade explains intra-industry trade among developed North countries.

Vertical IIT, meanwhile, may arise due to either vertical product differentiation or international product fragmentation. The former is the traditional explanation of vertical IIT, where a product is differentiated in terms of quality. Either the Heckscher-Ohlin or the Ricardian model of trade can be used to explain vertical IIT.[60] High (low)-quality varieties are assumed to be produced by a country with high (low) capital-to-labor ratio or with a technology that requires higher (lower) capital-to-labor ratio. The modern explanation of vertical IIT, meanwhile, stems from international product fragmentation. In this case, vertical IIT arises from the splitting of two or more production blocks and locating them across national borders.[61] Regardless of the reason for vertical IIT, it is clear that it occurs between North and South countries.

In the empirical literature, most studies employ unit price differentials or variants of it to separate horizontal from vertical IIT.[62] I do not proceed in this route, but instead I simply identify horizontal from vertical IIT by separating the country pairs. As the literature suggests, IIT between North countries is of the horizontal type and IIT between North and South countries is of the vertical type. A limitation, however, is that I am not able to

[59] See for instance Lancaster (1980), Helpman (1981), Dixit and Stiglitz (1977), and Krugman (1979, 1980, 1981)
[60] See for instance Falvey (1981), Flam and Helpman (1987), and Falvey and Kierzkowski (1987)
[61] See for instance Jones and Kierzkowski (1990) and Jones et al. (2002)
[62] See for instance Abd-el-Rahman (1991) and Greenaway, Hine, and Milner (1994, 1995)

distinguish whether vertical IIT is due to differentiation in product quality or international product fragmentation. Given the abundance of attention and empirical work in vertical IIT due to international product fragmentation, I believe there is enough evidence that vertical IIT due to international product fragmentation has grown more in importance compared to vertical IIT due to differences in product quality.

3. Difference in Financial Openness

I use the financial openness index constructed by Chinn and Ito (2007). This index (KAOPEN) varies from 0 to 1. Values closer to 1 imply non-existent capital account restrictions and values closer to 0 imply very restrictive capital account restrictions. It is based on binary dummy variables that codify the tabulation of restrictions on cross-border financial transactions reported in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER).* This index reflects the four major categories on regulatory restrictions on external accounts, namely:

(i) *k1*: variable indicating the presence of multiple exchange rates;
(ii) *k2*: variable indicating restrictions on current account transactions;
(iii) *k3*: variable indicating restrictions on capital account transactions; and
(iv) *k4*: variable indicating the requirement of the surrender of export proceeds.

For each country pair, the difference in financial openness was obtained. Thus, values closer to zero imply that a country pair has similar degree of financial openness; and values closer to one imply that a country pair has divergent degree of financial openness. The limitation of this variable, however, is that the values of the index may be close or even the same for two countries, but may not necessarily imply that they have the same restrictions for the same component of the index.

4. Political Proximity

I use the political proximity variable devised by Barro and Lee (2005). This variable varies from 0 to 1. It reflects the fraction of votes that each country casts in the United Nations General Assembly along with the United States. Values closer to zero imply that a country's votes in the U.N General Assembly are divergent with the votes cast by U.S. Values closer to one imply otherwise.

For each country pair, the difference in their political proximity with respect to the United States was obtained. Though this variable does not exactly measure the political proximity of a country pair, it may capture the similarity of their policies. Values closer to zero imply that a country pair has voted similarly; and values closer to one imply that a country pair has divergent votes.

References

Abd-el-Rahman, K. (1991). "Firms' Competitive and National Comparative Advantages as Joint Determinants of Trade Composition." *Weltwirtschaftliches Archiv*, 127(1), 83-97.

Ando, Mitsuyo (2005). Fragmentation and Vertical Intra-industry Trade in East Asia. Paper presented on Claremont Regional Integration Workshop with Particular Reference to Asia (Claremont McKenna College, U.S.A).

Anderson, Kym and Richard Blackhurst (1993). *Regional Integration and the Global Trading System*. New York: St. Martin's Press.

Arndt, S. W. (1998). "Globalization and the Gains from Trade." *Trade, Growth, and Economic Policy in Open Economies: Essays in Honour of Hans-Jurgen Vosgerau*. K.-J. Koch and K. Jaeger. Germany: Springer.

Arndt, Sven W. and Henryk Kierzkowski (2001). *Fragmentation: New Production Patterns in the World Economy*. Oxford: Oxford University Press.

Bagwell, Kyle and Robert W. Staiger (2003). "Protection and Business Cycle." *Advances in Economic Analysis & Policy*, 3(1).

Baier, Scott L. and Jeffrey H. Bergstrand (2004). "Economic Determinants of Free Trade Agreements." Journal of International Economics, 64, 29-63.

Baldwin, Robert E. (2001). "The Implications of Increasing Fragmentation and Globalization for the World Trade Organization," in L.K. Cheng and H. Kierzkowski, eds., Global Production and Trade in East Asia. Boston: Kluwer Academic Publishers, 249-271.

Barro, Robert L. and Jong-Wha Lee (2005). "IMF Programs:Who is chosen and what are the effects?" *Journal of Monetary Economics* 52, 1245-1269.

Baunsgaard, Thomas and Michael Keen (2005). "Tax Revenue and (or?) Trade Liberalization." *IMF Working Paper* 05/112.

Bhagwati, Jagdish and Arvind Panagariya (1996). *The Economics of Preferential Trade Agreements*. Washington, D.C.: The AEI Press.

Blanchard, Emily (2005). "Foreign Direct Investment, Endogenous Tariffs, and Preferential Trade Agreements." *SSRN Working Paper* 691469.

Bohara, Alok K. and William H. Kaempfer (1991). "A Test of Tariff Endogeneity in the U.S." The American Economic Review, 81(4), 952-960.

Cantwell, J. (1994). "The Relationship Between International Trade and International Production," D. Greenaway and L.A. Winters, *Surveys in International Trade*. Oxford: Basil Blackwell.

Chase, Kerry A. (2005). Trading Blocs: States, Firms, and Regions in the World Economy. Ann Arbor: The University of Michigan Press.

Cheng, Wen Li, and Meng-chun Liu, and Xiaokai Yang (2000). "A Ricardian Model with Endogenous Comparative Advantage and Endogenous Trade Policy Regimes." *The Economic Society of Australia*, 76, 172-82.

Chinn, Menzie D. and Hiro Ito (2007). "A New Measure of Financial Openness." Forthcoming in *Journal of Comparative Policy Anlaysis.*

Cheng, Leonard K. and Henryk Kierzkowski (2001). *Global Production and Trade in East Asia.* Boston: Kluwer Academic Publishers.

Deardorff, Alan V. and Robert M. Stern (1994). "Multilateral Trade Negotiations and Preferential Trading Agreements," in A. V. Deardorff and R. M. Stern, eds., *Analytical and* Negotiating Issues in the Global Trading System. Ann Arbor: University of Michigan Press, 27-85.

Deardorff, Alan V. (2001). "Fragmentation across Cones," in Sven W. Arndt and Henryk Kierzkowski, eds., *Fragmentation: New Production Patterns in the World Economy*. Oxford: Oxford University Press.

Dixit, A. and J. Stiglitz (1977). "Monopolistic Competition and Optimum Product Diversity." *American Economic Review*, 67(3), 297-308.

Dornbusch, Rudiger and Jeffrey A. Frankel (1987). "Macroeconomics and Protection," in Robert M. Stern, ed., *U.S. Policies in a Changing World Economy*. Cambridge: The Massachusetts Institute of Technology Press.

Ethier, Wilfred (1982). "National and International Returns to Scale in the Modern Theory of International Trade." *American Economic Review,* 72(3), 389-405.

Ethier, Wilfred (1998). "Regionalism in a Multilateral World." *Journal of Political Economy*, *106*(6), 1214-45.

Falvey, R. (1981). "Commercial policy and intra-industry trade." *Journal of International Economics,* 11(4), 495-511.

Falvey, R. and Kierzkowski, H. (1987). Product Quality, Intra-Industry Trade and (Im)Perfect Competition. in Kierzkowski, H. (ed.), *Protection and Competition in International Trade*. Oxford, Blackwell.

Flam, H. and Helpman, E. (1987). "Vertical Product Differentiation and North-South Trade." *American Economic Review,* 76(5), 810-822.

Frankel, Jeffrey A, Ernesto Stein, and Shang-Jin Wei (1996). "Regional Trading Arrangements: Natural or Supernatural." *American Economic Review*, 86(2), 52-56.

Freese, Jeremy and J. Scott Long. *Regression Models for Categorical Dependent Variables Using Stata.* College Station: Stata Press, 2006.

Greenaway, D., Hine, R.C. and Milner, C.R. (1994). "Country-Specific Factors and the Pattern of Horizontal and Vertical Intra-Industry Trade in the UK." *Weltwirtschaftliches Archiv*, 130(1), 77-100.

Greenaway, D., Hine, R.C. and Milner, C.R. (1995). "Vertical and Horizontal Intra-Industry Trade: A Cross-Industry Analysis for the United Kingdom." *Economic Journal*, 105(November), 1505-1518.

Greenaway, David, Peter Lloyd, and Chris Milner (2001). "Intra-industry Foreign Direct Investment and Trade Flows: New Measures of Global Competition," in L.K. Cheng and H. Kierzkowski, eds., *Global Production and Trade in East Asia.* Boston: Kluwer Academic Publishers, 111-128.

Grossman, Gene M. and Elhanan Helpman (1994). "Protection for Sale." *The American Economic Review*, 84(4), 833-850.

Harilal, K.N. and P.L. Beena (2003). "The WTO Agreement on Rules of Origin: implications for South Asia." Center for Development Studies Working Paper 353.

Haveman, Jon D. (1996). "Some Welfare Effects of Sequential Customs Union Formation." *Canadian Journal of Economics*, 29(4), 941-58.

Haveman, Jon D. (1998). Comment on "The Welfare Implications of Trading Blocs among Countries with Different Endowments," in J.A. Frankel, ed., *The Regionalization of the World Economy.* Chicago: University of Chicago Press, 149-151.

Helpman, Elhanan (1981). "International Trade in the Presence of Product Differentiation, Economies of Scale and Monopolistic Competition." *Journal of International Economics*, 11, 305-340.

Helpman, Elhanan and Paul R. Krugman (1985). *Market Structure and Foreign Trade*. Cambridge: The Massachusetts Institute of Technology Press.

Helpman, Elhanan and Paul R. Krugman (1989). *Trade Policy and Market Structure*. Cambridge: The Massachusetts Institute of Technology Press.

Henriques, Irene and Perry Sadorsky (1994). "The Determinants and Persistence of Canadian Tariff Rates." *The Canadian Journal of Economics*, 27(1), 112-128.

Jones, Ronald and Henryk Kierzkowski (1990). "The Role of Services in Production and International Trade: A Theoretical Framework," in R.W. Jones and A.O. Krueger, eds., The Political Economy of International Trade. Oxford: Basil Blackwell.

Jones, Ronald W. (2000). *Globalization and the Theory of Input Trade.* Cambridge: The MIT Press.

Jones, Ronald and Henryk Kierzkowski (2001a). "Horizontal Aspects of Vertical Fragmentation," in L.K. Cheng and H. Kierzkowski, eds., *Global Production and Trade in East Asia.* Boston: Kluwer Academic Publishers, 34-51.

Jones, Ronald W. and. Henryk Kierzkowski (2001b). "A Framework for Fragmentation," in Sven W. Arndt and Henryk Kierzkowski, eds., *Fragmentation: New Production Patterns in the World Economy*. Oxford: Oxford University Press.

Keen, M., and J. Ligthart (2001). "Coordinating Tariff Reductions and Domestic Tax Reform." *Journal of International Economics* 56: 407–25.

Kemp, Murray C. and Henry Y. Wan, Jr. (1976). "An Elementary Proposition Concerning the Formation of Customs Unions." *Journal of International Economics*, 6, 95-97.

Kimura, Fukunari (2001). "Intrafirm Fragmentation: Fujitsu, Ltd.'s Production of Hard Disk Drives," in L.K. Cheng and H. Kierzkowski, eds., *Global Production and Trade in East Asia.* Boston: Kluwer Academic Publishers, 289-293.

Kleinert, Jorn (2003). "Growing Trade in Intermediate Goods: Outsourcing, Global Sourcing, or Increasing Importance of MNE Networks?" *Review of International Economics,* 11(3), 464-482.

Krol, Robert Charles (1995). "Testing Tariff Endogeneity in Japan: A comparison of pre- and post-war periods." *Economic Letters*, 50(3), 399-406.

Krueger, Anne O. (1999). "Are Preferential Trading Arrangements Trade Liberalizing or Protectionist?" *Journal of Economic Perspectives*, *13*(4), 105-24.

Krugman, Paul R. (1979). "Increasing Returns, Monopolistic Competition, and International Trade." *Journal of International Economics*, 9(4).

Krugman, Paul R. (1980). "Scale Economies, Product Differentiation, and the Pattern of Trade." *American Economic Review*, 70(5), 950-59.

Krugman, Paul R. (1981). "Intra-industry Specialization anf the Gains from Trade." *The Journal of Political Economy*, 89(5), 959-973.

Krugman, Paul R. (1991a). "Is Bilateralism Bad?," in E. Helpman and A. Razin, eds., *International Trade and Trade Policy*. Cambridge: The MIT Press, 9-23.

Krugman, Paul R. (1991b). "The Move Towards Free Zones," in *Policy Implications of Trade and Currency Zones*, proceedings of a symposium sponsored by the Federal Reserve Bank of Kansas City, 7-41.

Lipson, Charles (1982). 'The Transformation of Trade: The Sources and Effects of Regime Change," *International Organization*, 36, 417-455.

Long, J. Scott (1997). *Regression Models for Categorical and Limited Dependent Variables*. Thousand Oaks: Sage Publications, 1997.

Magee, Stephen P. and William A. Brock and Leslie Young (1989). *Black hole tariffs and* endogenous policy theory: Political economy in general equilibrium. Cambridge: Cambridge University Press.

Magee, Christopher S. (2003). "Endogenous Preferential Trade Agreements: An Empirical Analysis." The B.E. Journal of Economic Analysis and Policy, 2(1).

Mas-Colell, Andreu, Michael D. Whinston, and Jerry R. Green (1995). *Microeconomic Theory.* New York: Oxford University Press.

Mayer, Christopher (1984). "Endogenous Tariff Formation." *American Economic Review*, 74(5), 970-85.

Medvedev, Denis (2006). "Beyond Trade: The Impact of Preferential Trading Agreements on Foreign Direct Investment Inflows." *World Bank Policy Research* Working Paper 4065.

Menon, Jayant (1994). "Trade Liberalisation, Closer Economic Relations and Intra-Industry Specialisation." *The Australian Economic Review*, 2nd Quarter.

Menon, Jayant and Peter B. Dixon (1996). "Regional Trading Agreements and Intra-industry Trade." *Journal of Economic Integration*, 11(1), 1-20.

Milner, Helen (1993). "Trading Places," in J. S. Odell and T.D. Willet, eds., *International Trade* Policies: Gains from Exchange Between Economics and Political Science. Ann Arbor: The University of Michigan Press, 141-172. \

Spilimbergo, Antonio and Ernesto Stein (1998). "The Welfare Implications of Trading Blocs among Countries with Different Endowments," in J.A. Frankel, ed., *The Regionalization of the World Economy.* Chicago: University of Chicago Press, 121-45.

UNCTAD (2000). World Investment Report 2000: Cross Border Mergers and Acquisitions And Development.

UNCTAD (2006). World Investment Report 2006: FDI from Developing and Transition Economies: Implications for Development.

Walkenhorst, Peter (2006). "Compensating Lost Revenue in Regional Trade Agreements." *World Bank Trade Note* 28.

Wooldridge, Jeffrey M. (2002). Econometric Analysis of Cross Section and Panel Data. Cambridge: The Massachusetts Institute of Technology Press.

World Bank (2005). Global Economic Prospects 2005: Trade, Regionalism and Development.

Appendix Table 1. Summary of Regional and Non-Regional Country Pairs and PTAs

	North-South			North-North			South-South		
	1995								
P(PTA*)	Same Region			Same Region			Same Region		
	0	1	Total	0	1	Total	0	1	Total
Frequency									
P(PTA*=0)	3546	222	3768	598	62	660	3149	913	4062
P(PTA*=1)	5	103	108	25	93	118	9	171	180
Total	3569	331	3900	623	155	778	3158	1084	4242
Percentage									
P(PTA*=1)	0.14%	31.12%	3%	4.01%	60.00%	15%	0.28%	15.77%	4%
	2006								
P(PTA*)	Same Region			Same Region			Same Region		
	0	1	Total	0	1	Total	0	1	Total
Frequency									
P(PTA*=0)	3424	218	3642	574	49	623	3143	867	4010
P(PTA*=1)	122	4	126	24	3	27	6	46	52
Total	3546	224	3770	598	52	650	3149	913	4062
Percentage									
P(PTA*=1)	3.44%	1.79%	3%	4.01%	5.77%	4%	0.19%	5.04%	1%

Source: www.wto.org

Notes: Classification of countries into North and South is based on their average Human Development Index from 1980-2005. PTA*= 1 if a PTA exists between two countries and PTA*= 0 otherwise.
Same region = 1 if two countries are in the same region and same region = 0 otherwise. Top panel shows the number of country pairs that are not in a PTA in 1980, but have one in 1995. Bottom panel shows the country pairs that are not in a PTA in 1995, but have one in 2006.

Appendix Table 2. Indicators of International Production

Item	Value at Current Prices (Billions of dollars)			Annual Growth Rate (Per cent)		
	1982	1990	2005	1986-1990	1991-1995	1996-2000
Gross Product of Foreign Affiliates	646	1481	4517	17.4	6.9	8.8
Sales of Foreign Affiliates	2620	6045	22171	19.7	8.9	10.1
FDI outward stock	600	1791	10672	18.0	10.7	18.9
FDI inward stock	647	1789	10130	16.8	9.3	17.3
GDP	10899	21898	44674	11.1	5.9	1.3
Exports of goods and non-factor services	2247	4261	12641	12.7	8.7	3.6

Source: World Investment Report 2006 (UNCTAD)

Appendix Table 3. Variable Definitions and Sources

Variable	Defintion	Source
PTA*	=1 if country pair has a PTA in year t; 0 otherwise	www.wto.org
Log of distance	ln(distance between countries in 1000 km)	CIA World Factbook
Log of total bilateral trade	$\ln(Ex_{hf}+Im_{hf})$; where Ex_{hf} = total exports of country h to f and Im_{hf} = total imports of country h from f	Computed from World Trade Analyzer
Inter-industry trade or Net Trade	$\ln(\Sigma_r \lvert Ex_{hf,r} - Im_{hf,r}\rvert)$; where $Ex_{hf,r}$ = total value of exports in industry r from country h to f and $Im_{hf,r}$ = total value of imports in industry r of country h from f at the four-digit SITC level of commodity classification	Computed from World Trade Analyzer
Intra-indsutry trade	$1-[\Sigma_r \lvert Ex_{hf,r} - Im_{hf,r}\rvert/\Sigma_r (E_{xhf,r} - Im_{hf,r})]$; where $Ex_{hf,r}$ = total value of exports in industry r from country h to f and $Im_{hf,r}$ = total value of imports in industry r of country h from f at the four-digit SITC level of commodity classification	Computed from World Trade Analyzer
Difference in Economic Size	absolute value of the difference in real GDP of country h and f	www.imf.org
Difference in Capital to Labor Ratio	absolute value of the difference in capital-labor ratio of country h and f	Dutt and Mitra (2002)
Difference in Financial Openness	absolute value of the difference in the Chinn & Ito financial openness index	Chinn & Ito (2006)
Trade balance	$\Sigma\lvert Ex_{hf} - Im_{hf}\rvert/\Sigma(E_{xhf} - Im_{hf})$; where Ex_{hf} = total exports of country h to f and Im_{hf} = total imports of country h from f	Computed from World Trade Analyzer
Political Proximity	absolute value of the difference in the Barro and Lee political proximity index	Barro and Lee (2005)
Same language	=1 if the two countries have the same official langauge	www.haveman.org
Both democracies	=1 if the two countries are democracies	CIA World Fact Book
Same Region	=1 if country pair belong to the same region; 0, otherwise	www.unctad.org

Notes: Except for Net Trade, Difference in Financial Openness, and Political Proximity, all data were from Magee (2003) dataset.

Appendix Table 4. Classification of Countries

North Countries	**South Countries**	
(High HDI)	(Medium HDI)	(Low HDI)
Argentina	Albania	Angola
Australia	Algeria	Bangladesh
Austria	Bahrain	Benin
Bahamas	Belize	Burkina Faso
Barbados	Bhutan	Burundi
Belgium	Bolivia	Cameroon
Brunei Darussalam	Brazil	Central African Republic
Canada	Bulgaria	Chad
Cyprus	Cambodia	Congo, Dem. Rep. of the
Denmark	Chile	Côte d'Ivoire
Finland	China	Djibouti
France	Colombia	Ethiopia
Germany	Congo	Gambia
Greece	Costa Rica	Guinea
Hong Kong	Dominican Republic	Guinea-Bissau
Hungary	Ecuador	Haiti
Iceland	Egypt	Lao People's Dem. Rep.
Ireland	El Salvador	Madagascar
Israel	Fiji	Malawi
Italy	Gabon	Mali
Japan	Ghana	Mauritania
Korea, Republic of	Guatemala	Mozambique
Kuwait	Guyana	Nepal
Luxembourg	Honduras	Niger
Malta	India	Nigeria
Netherlands	Indonesia	Pakistan
New Zealand	Jamaica	Papua New Guinea
Norway	Jordan	Rwanda
Poland	Kenya	Senegal
Portugal	Lebanon	Sierra Leone
Qatar	Malaysia	Sudan
Saint Kitts and Nevis	Maldives	Tanzania
Seychelles	Mauritius	Togo
Singapore	Mexico	Uganda
Spain	Mongolia	Yemen
Sweden	Morocco	Zambia
Switzerland	Myanmar	
United Arab Emirates	Netherlands Antilles	
United Kingdom	Nicaragua	
United States	Oman	
Uruguay	Panama	
	Paraguay	
	Peru	
	Philippines	
	Romania	
	Saudi Arabia	
	Solomon Islands	
	South Africa	
	Sri Lanka	
	Suriname	
	Taiwan	
	Thailand	
	Trinidad and Tobago	
	Tunisia	
	Turkey	
	Venezuela	
	Viet Nam	
	Zimbabwe	

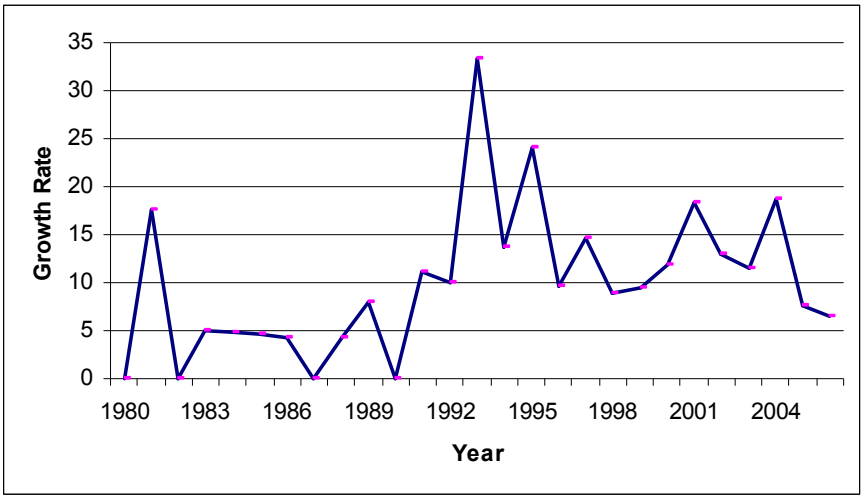
Source: Human Development Report (http://hdr.undp.org/reports/)

Appendix Table 5. Summary Statistics for each Country Pair

Explanatory Variables	1980 North-South Mean	North-South Standard Deviation	North-South Minimum	North-South Maximum	1980 North-North Mean	North-North Standard Deviation	North-North Minimum	North-North Maximum	1980 South-South Mean	South-South Standard Deviation	South-South Minimum	South-South Maximum
Distance (in log)	1.96	0.62	-2.18	2.99	1.83	0.81	-1.13	2.99	1.86	0.77	-1.93	2.99
Total Bilateral Trade (in log)	6.34	4.58	0	16.90	9.56	4.35	0	18.03	2.63	3.80	0	15.31
Inter-industry Trade (in log)	6.60	4.52	0	16.50	9.69	4.17	0	17.99	2.74	3.95	0	15.64
Intra-industry Trade Index	0.01	0.04	0	0.86	0.05	0.09	0	0.62	0.01	0.02	0	0.60
Difference in GDP	2.89	1.97	0	11.17	2.59	2.09	0	10.97	2.02	1.53	0	8.94
Difference in K/L	2.29	1.43	0	6.19	0.85	0.60	0	2.91	1.58	1.14	0	5.77
(Difference in K/L)^2	7.29	7.71	0	38.28	1.09	1.32	0	8.48	3.80	4.74	0	33.34
Difference in Financial Openness	1.82	1.36	0	4.37	1.69	1.24	0	3.91	1.72	1.20	0	4.37
Trade Balance	0.49	0.41	0	1	0.47	0.36	0	1	0.32	0.45	0	1
Political Proximity	0.18	0.17	0	0.86	0.22	0.18	0	0.81	0.09	0.08	0	0.50
Same Language	0.08	0.28	0	1	0.08	0.27	0	1	0.13	0.33	0	1
Both Democratic	0.77	0.42	0	1	0.75	0.44	0	1	0.78	0.42	0	1
Same Region	0.08	0.29	0	1	0.20	0.40	0	1	0.26	0.44	0	1

Explanatory Variables	1995 North-South Mean	North-South Standard Deviation	North-South Minimum	North-South Maximum	1995 North-North Mean	North-North Standard Deviation	North-North Minimum	North-North Maximum	1995 South-South Mean	South-South Standard Deviation	South-South Minimum	South-South Maximum
Distance (in log)	1.99	0.58	-1.89	2.99	2.08	0.55	-0.84	2.99	1.92	0.73	-1.69	2.99
Total Bilateral Trade (in log)	7.07	4.63	0	18.05	9.97	4.41	0	18.76	3.32	4.09	0	15.07
Inter-industry Trade (in log)	7.50	4.58	0	17.80	10.70	4.19	0	18.71	3.81	4.37	0	16.22
Intra-industry Trade Index	0.03	0.06	0	0.75	0.07	0.10	0	0.60	0.02	0.03	0	0.75
Difference in GDP	3.31	2.09	0.01	10.28	2.83	2.12	0	10.38	2.07	1.56	0	7.93
Difference in K/L	2.00	0.73	0.01	3.43	0.66	0.46	0	2.23	0.54	0.45	0	2.01
(Difference in K/L)^2	4.54	2.76	0	11.76	0.64	0.77	0	4.98	0.48	0.73	0	4.06
Difference in Financial Openness	2.02	1.26	0	4.13	1.48	1.22	0	3.74	1.18	1.04	0	4.24
Trade Balance	0.49	0.39	0	1	0.52	0.36	0	1	0.37	0.44	0	1
Political Proximity	0.15	0.17	0	0.92	0.19	1.22	0	3.74	0.03	0.05	0	0.34
Same Language	0.08	0.27	0	1	0.08	0.27	0	1	0.12	0.32	0	1
Both Democratic	0.78	0.42	0	1	0.71	0.45	0	1	0.78	0.41	0	1
Same Region	0.06	0.24	0	1	0.09	0.29	0	1	0.22	0.42	0	1

Appendix Figure 1. Growth of Preferential Trading Agreements (1980-2006)



Source: www.wto.org

Appendix Table 6. Impact of Other Variables on PTA Formation

	NN			NS			SS		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Panel A: PTA formed form 1981-1995								
Difference in Market Size	-0.0025**	-0.0018**	-0.0035**	-0.0003**	-0.0003**	-0.0004**	-0.0005	-0.0003	-0.0006
	(0.105)	(0.105)	(0.101)	(0.039)	(0.039)	(0.038)	(0.030)	(0.031)	(0.030)
Difference in K/L Ratio	0.0068	0.0065	0.0073	0.0023**	0.0024**	0.0028**	0.0037	0.0031	0.0026
	(1.074)	(1.109)	(1.027)	(0.239)	(0.238)	(0.239)	(0.142)	(0.143)	(0.141)
(Difference in K/L Ratio)^2	-0.0072	-0.0069	-0.0104	-0.0008**	-0.0009**	-0.0010**	-0.0020	-0.0018	-0.0020
	(0.789)	(0.828)	(0.751)	(0.065)	(0.065)	(0.066)	(0.040)	(0.040)	(0.040)
Difference in Financial Openness	-0.0005	-0.0005	-0.0005	0.0001	0.0001	0.0002	-0.0021*	-0.0017*	-0.0015
	(0.106)	(0.108)	(0.103)	(0.051)	(0.052)	(0.050)	(0.036)	(0.036)	(0.036)
Trade Balance	-0.0118**	-0.0084**	-0.0167**	-0.0033**	-0.0028**	-0.0023**	-0.0166**	-0.0100**	-0.0048
	(0.450)	(0.452)	(0.436)	(0.194)	(0.185)	(0.178)	(0.131)	(0.108)	(0.108)
Political Proximity	-0.0033	-0.0032	-0.0016	-0.0019	-0.0012	-0.0001	-0.0632**	-0.0546**	-0.0644**
	(0.733)	(0.744)	(0.725)	(0.413)	(0.404)	(0.395)	(0.636)	(0.639)	(0.630)
Both Democratic[a]	0.0072**	0.0067**	0.0126**	0.0006	0.0008	0.0009	-0.0233**	-0.0235**	-0.0224**
	(0.755)	(0.725)	(0.701)	(0.196)	(0.194)	(0.194)	(0.098)	(0.100)	(0.097)
Same Language[a]	0.0012	0.0017	0.0041	0.0215**	0.0224**	0.0239**	0.0112**	0.0110**	0.0147**
	(0.547)	(0.545)	(0.502)	(0.152)	(0.151)	(0.149)	(0.101)	(0.102)	(0.099)
	Panel B: PTA formed form 1996-2006								
Difference in Market Size	-0.0057**	-0.0060**	-0.0063**	-0.0017**	-0.0018**	-0.0040**	-0.0002*	-0.0002*	-0.0002
	(0.085)	(0.084)	(0.084)	(0.037)	(0.036)	(0.035)	(0.077)	(0.076)	(0.076)
Difference in K/L Ratio	0.0190	0.0248	0.0332	0.0052*	0.0076**	0.0120**	-0.0003	-0.0001	0.0002
	(1.064)	(1.067)	(1.091)	(0.346)	(0.336)	(0.322)	(0.732)	(0.711)	(0.708)
(Difference in K/L Ratio)^2	-0.0236	-0.0289	-0.0299	-0.0026**	-0.0034**	-0.0057**	-0.0001	-0.0003	-0.0006
	(0.778)	(0.787)	(0.806)	(0.100)	(0.027)	(0.093)	(0.572)	(0.556)	(0.559)
Difference in Financial Openness	0.0071**	0.0070**	0.0057**	0.0018**	0.0020**	0.0054**	-0.0005**	-0.0006**	-0.0006**
	(0.099)	(0.095)	(0.098)	(0.053)	(0.053)	(0.048)	(0.132)	(0.132)	(0.126)
Trade Balance	-0.0136	-0.0194*	-0.0027	-0.0039**	-0.0036**	-0.0036*	-0.0005	-0.0004	-0.0002
	(0.385)	(0.360)	(0.401)	(0.177)	(0.171)	(0.149)	(0.257)	(0.235)	(0.211)
Political Proximity	-0.0279	-0.0246	-0.0303	0.0085**	0.0114**	0.0341**	0.0018	0.0020	0.0038
	(0.789)	(0.784)	(0.804)	(0.354)	(0.342)	(0.318)	(2.047)	(2.037)	(1.968)
Both Democratic[a]	***	***	***	0.0071**	0.0080**	0.0144**	***	***	***
				(0.356)	(0.345)	(0.349)			
Same Language[a]	***	***	***	-0.0028**	-0.0030**	-0.0054**	0.0042**	0.0045**	0.0057**
				(0.268)	(0.262)	(0.243)	(0.165)	(0.165)	(0.165)

Notes: Reported coefficients are marginal effects.
a - Reported coefficeints are the impact when there is a discrete change in the dummy variable from 0 to 1.
** and * indicate statistical significance at 5% level and 10% level, repsectively. Values in ( ) are standard errors.
*** indicates perfect failure if Same Language = 0 and Both Democratic = 1.